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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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E09	25.50	51.00
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VOLUME 25 NUMBER 6 / MARCH 23, 1987

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

01 AERONAUTICS (GENERAL) 709

02 AERODYNAMICS 709

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 717

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 719

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications and Radar.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 720

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

06 AIRCRAFT INSTRUMENTATION 722

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 722

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 726

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

09 RESEARCH AND SUPPORT FACILITIES (AIR) 726

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 727

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS 727

Includes powered and free-flight trajectories; and orbital and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 728

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

16 SPACE TRANSPORTATION 729

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 729

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 729

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 736

Includes main propulsion systems and components, e.g. rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

23 CHEMISTRY AND MATERIALS (GENERAL) 739

24 COMPOSITE MATERIALS 740

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials.*

25 INORGANIC AND PHYSICAL CHEMISTRY 742

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS 747

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 752

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

28 PROPELLANTS AND FUELS 756

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

29 MATERIALS PROCESSING 756

Includes space-based development of products and processes for commercial application.

For biological materials see *55 Space Biology.*

ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics.*

31 ENGINEERING (GENERAL) 757

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR 759

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 764

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 768

Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 775

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 778

Includes parametric amplifiers.

For related information see also *76 Solid-State Physics.*

37 MECHANICAL ENGINEERING 781

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 783

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 784

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES AND REMOTE SENSING **789**

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **791**

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

45 ENVIRONMENT POLLUTION **792**

Includes atmospheric, noise, thermal, and water pollution.

46 GEOPHYSICS **794**

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY **796**

Includes weather forecasting and modification.

48 OCEANOGRAPHY **799**

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

51 LIFE SCIENCES (GENERAL) **800**

52 AEROSPACE MEDICINE **801**

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 BEHAVIORAL SCIENCES **802**

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **804**

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

55 SPACE BIOLOGY **N.A.**

Includes exobiology; planetary biology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **805**

60 COMPUTER OPERATIONS AND HARDWARE **805**

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE **807**

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 COMPUTER SYSTEMS **811**

Includes computer networks and special application computer systems.

63 CYBERNETICS **812**

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **813**

Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY **816**

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS **N.A.**

Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS **818**

Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering.*

70 PHYSICS (GENERAL) **819**

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

71 ACOUSTICS 819
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 820
Includes atomic structure, electron properties, and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 821
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 821
Includes light phenomena and optical devices.
For lasers see *36 Lasers and Masers.*

75 PLASMA PHYSICS 825
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 826
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS N.A.
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 829
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 830
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY 830
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 831
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 832

89 ASTRONOMY 832
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 833
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 852
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 854
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 854
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

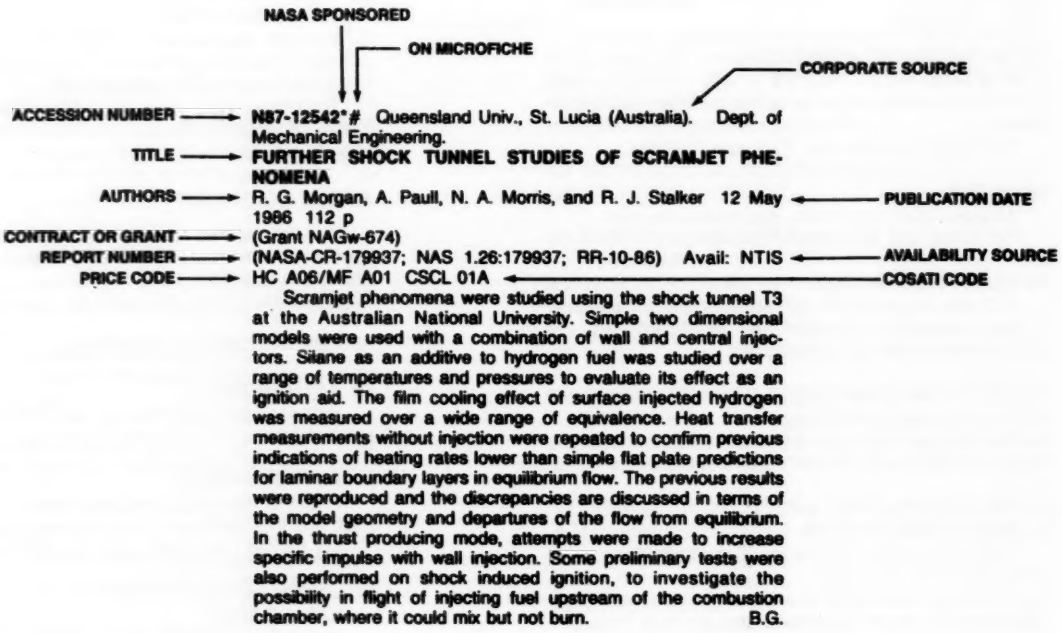
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL 854

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-55
CORPORATE SOURCE INDEX I-63
CONTRACT NUMBER INDEX I-75
REPORT/ACCESSION NUMBER INDEX I-77

TYPICAL CITATION AND ABSTRACT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ACCESSION NUMBER
N87-12542*# Queensland Univ., St. Lucia (Australia). Dept. of Mechanical Engineering.
TITLE
FURTHER SHOCK TUNNEL STUDIES OF SCRAMJET PHENOMENA
AUTHORS
R. G. Morgan, A. Paull, N. A. Morris, and R. J. Stalker 12 May 1986 112 p
PUBLICATION DATE
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REPORT NUMBER
(NASA-CR-179937; NAS 1.26:179937; RR-10-86) Avail: NTIS
AVAILABILITY SOURCE
PRICE CODE
HC A06/MF A01 CSCL 01A
COSATI CODE
Scramjet phenomena were studied using the shock tunnel T3 at the Australian National University. Simple two dimensional models were used with a combination of wall and central injectors. Silane as an additive to hydrogen fuel was studied over a range of temperatures and pressures to evaluate its effect as an ignition aid. The film cooling effect of surface injected hydrogen was measured over a wide range of equivalence. Heat transfer measurements without injection were repeated to confirm previous indications of heating rates lower than simple flat plate predictions for laminar boundary layers in equilibrium flow. The previous results were reproduced and the discrepancies are discussed in terms of the model geometry and departures of the flow from equilibrium. In the thrust producing mode, attempts were made to increase specific impulse with wall injection. Some preliminary tests were also performed on shock induced ignition, to investigate the possibility in flight of injecting fuel upstream of the combustion chamber, where it could mix but not burn. B.G.

VOLUME 25 NUMBER 6 / MARCH 23, 1987

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N87-14243 British Aerospace Aircraft Group, Bristol (England). Advanced Manufacturing Research Dept.
FIRST INTERNATIONAL CONFERENCE MATERIALS IN AEROSPACE
D. Charles, comp. 1986 16 p Conference held in London, England, 2-4 April 1986
(BAe-S85/AMR/0080; ETN-86-98152) Copyright. Avail: Issuing Activity

The conference organized by the Royal Aeronautical Society is described. Keynote papers on materials and their applications were presented by speakers from leading aerospace companies and academic institutions. Opportunities were given for discussion of the topics covered by the speakers and a more general discussion was held at the close of each session. In addition to the paper presented there was a small exhibition by materials producers and processors. Some topics covered were: Surface treatment of steels; Titanium castings; Lubrication; Thermoplastic composites; Rapidly solidified aluminum alloys; Self reinforcing polymers; Carbon-carbon composites; High temperature titanium alloys; Development of super alloys; Ceramics; Developments in adhesives; Aluminum lithium alloys; Fire/smoke/toxicity; and Corrosion protection. E.R.

N87-14244 Civil Aviation Authority, London (England).
RELIABILITY OF IN-SERVICE INSPECTION OF TRANSPORT AIRCRAFT STRUCTURES Final Report
M. W. B. Lock and J. E. Strutt Aug. 1985 120 p Sponsored by United Kingdom Air Registration Board
(CAA-Paper-85013; ISBN-0-86039-251-1; ETN-87-98602) Copyright. Avail: Issuing Activity

The reliability of structural inspection of transport aircraft, particularly the influence of human factors on the performance of inspection was studied. Data for the study was obtained from discussions with and visits to operators; mandatory occurrence reports; a questionnaire circulated amongst aircraft operating companies; and by detailed task analysis at shop floor level. The importance of performance-shaping factors to the inspection activity is established. The results suggest that the most critical steps are defect searching and recognition, and that greater attention should be paid to primary and secondary access, lighting, and eyesight. ESA

N87-14245* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 207)
Dec. 1986 138 p
(NASA-SP-7037(207); NAS 1.21:7037(207)) Avail: NTIS HC A07 CSCL 01A

This bibliography lists 484 reports, articles and other documents introduced into the NASA scientific and technical information system in November 1986. Author

N87-14246# Fulmer Research Inst. Ltd., Stoke Poges (England).
AN ASSESSMENT OF AIRCRAFT REPAIR SCHEMES FOR BATTLE DAMAGE AND PERMANENT USAGE Final Report
S. P. Shenton, J. Wilson, and D. P. Bashford 6 Jan. 1986 63 p (Contract MOD-A91a/906)
(R946/8; BR98808; ETN-86-98380) Avail: NTIS HC A04/MF A01

A wet laminating system for temporary fiber reinforced plastic repairs to secondary metallic structures of aircraft was established. Repairs can be implemented in-the-field, with minimum resources or prior knowledge of the materials, permitting the aircraft to be operational within 4 hr. The good short term tensile, fatigue, and environmental resistance achieved by wet laminated patches led to their consideration for repairs having a permanent status. These repairs would be cheap to implement. For such repairs more appropriate resin systems and preparation techniques are needed to provide better conditions for long-term performance. Results show that good static tensile performance can be maintained when subjected to extremes of temperature. Induced moisture absorption causes a reduction in tensile strength at elevated temperatures. ESA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N87-14247# National Aerospace Lab., Tokyo (Japan).
PROCEEDINGS OF THE 3RD NAL SYMPOSIUM ON AIRCRAFT COMPUTATIONAL AERODYNAMICS Special Publication of the National Aerospace Lab.
Nov. 1985 266 p Symposium held in Tokyo, Japan, 13-14 Jun. 1985
(NAL-SP-5; ISSN-0289-260X) Avail: NTIS HC A12/MF A01

Topics addressed include: computational fluid dynamics, aerodynamic characteristics, wing and airfoil design, wake structure, numerical grid generation, wind tunnel tests, Navier-Stokes equations, laminar flow control, boundary condition effects, flow simulation, nozzle geometry, supercomputers, and aircraft icing. For individual titles, see N87-14248 through N87-14277.

N87-14248# National Aerospace Lab., Tokyo (Japan). c05
NUMERICAL SIMULATION OF AN AIRCRAFT ICING
Daisuke Takahashi and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 1-6 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A finite difference method was developed to simulate aircraft icing. An air flow was calculated by solving compressible Navier-Stokes equations directly. The accretion of ice to the NACA0012 airfoil at various angles of attack was calculated from trajectories of supercooled liquid drops through that flow. Author

N87-14249# National Aerospace Lab., Tokyo (Japan).
NUMERICAL ANALYSIS OF NOZZLE AND FREE-JET FLOWS OF PARTICLE MIXTURES **c34**
Ryuji Ishii *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 7-12 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A numerical analysis of nozzle and free-jet flows of gas-particle mixtures is described. The National Space Development Agency of Japan (NASDA) plans to develop a satellite launcher called the H-II. For the basic design of the H-II rocket, thermal protection of the rocket wall against strong heating due to thermal radiation from the jet exhaust from the nozzles is considered to be important. The thermal emissivity of solid particles is by far larger than that of gas for typical firing conditions of rocket engines with solid propellants. Therefore, the determination of flow field of the particle-phase in the jet-plume is especially important. In the present calculation, the two-step MacCormack algorithm is used for the gas-phase flow and the method of characteristics is applied to the particle-phase flow. Thus the present numerical algorithm is a mixed algorithm. To investigate and confirm the accuracy and the reliability of the numerical results, another mixed scheme consisting of PLM (Piecewise Linear Interpolation Method) for the gas-phase flow and the method of characteristics for the particle-phase flow is also applied. The numerical results obtained by these two methods are compared with each other. Author

N87-14250# National Aerospace Lab., Tokyo (Japan).
TECHNIQUES TO ACHIEVE HIGH-SPEED COMPUTATIONS IN SUPERCOMPUTERS **c60**
Tadashi Watanabe *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 20-25 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-03)
Avail: NTIS HC A12/MF A01

Various techniques to achieve high-speed computations in supercomputers are described. In particular, architectural approaches to augment concurrency are described. Those approaches include multiprocessors, parallel processors, and pipelined processors. A multiprocessor system is one in which plural processors share the main memory and different programs are executed on each processor. The multiprocessor enhances the system throughput by the concurrent execution of programs. In a parallel processor system, plural processors are connected to each other directly or through a memory unit, and all the processors execute the identical instruction simultaneously under the control of the control unit. In a pipelined processor, instruction execution is streamlined like an assembly line of an automobile factory or the processing procedure in a chemical plant. Next, vector processing for achieving high-speed computations is outlined. Finally, as an example of supercomputers, the vector processing feature of the NEC supercomputer SX system is introduced. The SX system employs multiple-parallel pipelines and 512 way-interleaved memory system to achieve a vector processing speed of 1.3 G flops. Author

N87-14251# National Aerospace Lab., Tokyo (Japan).
VP SERIES HARDWARE **c60**
Keiichiro Uchida and Kazushi Sakamoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 27-32 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

In the field of numerical analysis for fluid dynamics, there are plenty of calculations which deal with a large number of three-dimensional array data. Supercomputers were developed to satisfy the need for faster-speed scientific and engineering computation, mainly using the pipeline processing method. A supercomputer must achieve not only maximum performance but also effective performance. The parallel execution of instructions is important to increase effective performance. The FACOM-VP provides a number of instruction execution pipelines and a control method that makes these pipelines proceed effectively to achieve parallel processing in addition to the pipeline processing method. The technique used in the FACOM-VP to execute a scalar instruction and vector instructions in parallel and also vector instructions in parallel is explained. Author

N87-14252# National Aerospace Lab., Tokyo (Japan).
ON A DATA BASE SYSTEM FOR NUMERICAL SIMULATOR **c82**
Tadao Ishizuka, Hajime Miyoshi, and Takayuki Aki *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 33-41 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

The necessity for computer simulation in research and development in aeronautics and astronautics has increased at a rapid pace in recent years. In particular, sophisticated large and fast computers are required to perform simulations at a practical level. The National Aerospace Laboratory of Japan is now promoting a numerical simulator project (NS project), which includes the introduction of a supercomputer. As a part of this project, a data base system was constructed for the purpose of managing input and test data necessary for numerical simulation and allowing many different kinds of utilization. The summary of this data base system and the functions of operational commands employed in the system are explained from the viewpoint of the user. Firstly, data available in this system are considered. Secondly, ways of creating a data base system that meets the demands of the field of numerical simulation are discussed. Thirdly, major features of the operational commands are explained. Finally, a list of operational commands and examples are presented. Author

N87-14253# National Aerospace Lab., Tokyo (Japan).
DATABASE ORIENTED UNIX OPERATING ENVIRONMENT AND ITS APPLICATION **c60**
Masayuki Hatakeyama *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 43-50 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A work station system is proposed which is equipped with a large capacity hard disk. The work station operates under the UNIX operating environment. In this work station system, a general purpose database oriented system for both scientific studies and engineering purposes is constituted. A flexible and simple format is designed for the data file. A software bus concept is proposed to provide a common path for data transmissions. On the basis of this software bus concept, the database system is developed using the modular programming technique. The DBMS (Database Management System) now developed is a relational type DBMS, and is also based on the software bus concept. As for the graphic display system, it is developed by combining the native commands of the intelligent graphic terminal and siggraph-CORE system. It is confirmed that the database system now developed is useful for analyzing unknown phenomena by applying this database system to a fluid dynamical problem. Author

N87-14254# National Aerospace Lab., Tokyo (Japan).
IMPLICIT TIME-MARCHING METHODS FOR THE TRANSONIC EULER EQUATIONS **c64**
Hisaaki Daiguji *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 51-60 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Implicit time-marching methods for solving the compressible Euler equations in general curvilinear coordinates are presented,

laying stress on treatments of the solid wall boundary. In one of the present methods, the momentum equations of contravariant velocity components are used instead of the momentum equations of physical velocity components in the existing equations. The numerical methods are based on the well-known Beam-Warming delta-form approximate-factorization scheme (1978), and make use of the diagonal form by Pulliam-Chausse (1981) and the flux splitting by Steger-Warming (1981). Use of these two techniques requires less computational work and is capable of taking a sufficiently large Courant number. The finite-difference equations obtained finally can be easily solved by dividing them into five steps. The first, third, and fifth steps are products of matrix by vector, and the second and fourth steps are the calculation of a system of linear equations with a tri-diagonal matric by Gaussian elimination. The values of the residual, i.e., right hand side, including at and near the boundary points, can be completely reduced to zero by these treatments. Author

N87-14255# National Aerospace Lab., Tokyo (Japan).
THREE-DIMENSIONAL POTENTIAL FLOW SIMULATIONS FOR TRANSONIC INLETS
Takashi Nakamura *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 61-68 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A highly efficient computer analysis is developed for the prediction of the transonic nacelle/inlet flowfield. This algorithm can compute the three-dimensional transonic flowfield about axisymmetric or asymmetric nacelle/inlet configurations with or without centerbody at zero or nonzero incidence. The flowfield is determined by solving the full-potential equation in conservative form on a body-fitted curvilinear coordinate system. The coordinate system is generated by the conformal mapping method. The difference equations are solved using the AF2 approximate factorization scheme. Computed results are presented to illustrate application of this analysis. Author

N87-14256# National Aerospace Lab., Tokyo (Japan).
COMPRESSIBLE FLOW ANALYSIS IN TURBOMACHINERY **c34**
Masahiro Ikegawa, Yoshio Shikano, and Susumu Nakano *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 69-75 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Compressible flow analysis in turbomachinery is an important engineering problem in improving the performance of these machines. Recent remarkable advances in computer capabilities and solution algorithms enable calculation of complete three dimensional flows. Three dimensional potential flow analysis by the finite element method, and two and three dimensional turbulent flow analysis based on the two-equation turbulence model proposed by Launder and Spalding are presented. For potential flow analysis, a nonlinear partial differential equation with respect to velocity potential is formulated by the method of weighted residuals and is solve by the Newton-Raphson method. To calculate turbulent flows in arbitrarily shaped flow regions, a control volume method combined with the body-fitted curvilinear coordinate system is developed to obtain spatially discretized governing equations. As numerical examples, three dimensional potential flow in turbine blades and centrifugal compressors, and two and three dimesional turbulent flow in turbine nozzles are analyzed. These results are compared with experimental data. It is concluded that potential flow analysis can be effectively employed as a design tool for turbomachinery. Author

N87-14257# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENT OF THE HIGHLY LOADED AXIAL FLOW TURBINE AIRFOILS, MAKING USE OF THE IMPROVED INVERSE CHANNEL FLOW DESIGN METHOD **c34**
Keisuke Hashimoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 77-87 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

To reduce the number of the turbine airfoils or the solidity as far as possible without increasing energy loss, a study of highly loaded turbine airfoils was conducted. These airfoils were designed for the typical velocity diagrams of the first and second stages of a jet engine low pressure turbine. With regard to the design procedures, an improved inverse method, and also a boundary layer analysis technique were employed to optimize the airfoil shapes. These airfoils, and state-of-the-art aft loaded conventional airfoils designed for almost equivalent velocity diagrams were tested in the high speed cascade wind tunnel. The airfoils showed lower kinetic energy loss coefficient characteristics and wider useful incidence ranges over the wider range extended to the high subsonic regime compared with the aft loaded ones, in spite of their higher loading. In addition to some main parts of the design procedures, theoretical and experimental results are discussed. Author

N87-14258# National Aerospace Lab., Tokyo (Japan).
AN EASILY VECTORIZABLE NUMERICAL SOLUTION OF THE EULER EQUATIONS **c64**
Koji Morinishi, Nobuyuki Satofuka, and Hidetoshi Nishida *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 89-95 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

An efficient method was devised for solving the Euler equations. The method is based on a combination of the central finite difference approximation to the space variables with the rational Runge-Kutta time integration scheme. To improve the rate of convergence to the steady state solution, residual averaging and a multigrid technique are incorporated into the basic scheme. The algorithm is very simple to program, easily vectorized without any additional requirement such as extra memory, and easy to extend to multidimensional problems. A series of numerical experiments using the present method was performed on the quasi-one-dimensional nozzle flow problem with shock and two dimensional transonic flows over an airfoil. With the implicit residual averaging, the present method is stable until the Courant number reaches about 50. The convergence rate does not monotonously improve as the Courant number is increased. The maximum efficiency for a steady state solution is achieved with a local Courant number of approximately 5. Numerical results for two dimensional transonic flow past airfoils indicate that the efficiency of the present method is just as good as that of the Beam Warming scheme. Author

N87-14259# National Aerospace Lab., Tokyo (Japan).
A FINITE ELEMENT METHOD FOR HIGH REYNOLDS NUMBER FLOW **c34**
Ryutaro Himeno and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 97-101 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A finite element method was developed, which has a higher-order accuracy with fourth order artificial dissipation. Flows in a two-dimensional duct and in a back-step duct were calculated. It was found that this scheme works well at high Reynolds numbers. Author

N87-14260# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENTS OF NAVIER-STOKES CODE FOR HYPERSONIC SPACE-FLIGHT VEHICLES **c05**
Yukimitsu Yamamoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 103-111 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A thin-layer, compressible Navier-Stokes code was developed for the hypersonic flow over space flight vehicles. The implicit approximate factorization algorithm proposed by Beam and

Warming was used to obtain numerical solutions. Implicit boundary conditions are also applied to the body and shock wave surfaces, which enable the numerical scheme to be stable and robust. Grid systems orthogonal to the body surface can be generated by the fast conformal transformations. Calculations were made for the flow around bluff bodies, indented blunt bodies, and rockets in order to investigate aerothermodynamic characteristics. Numerical results indicate that there exists three types of severe aerodynamic heating, which may exceed stagnation point heating on the body surface. Author

N87-14261# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENT OF SUPERSONIC COMPUTATIONAL AERODYNAMIC PROGRAM USING PANEL METHOD
Yuichi Maruyama, Sadao Akishita, and Akihito Nakamura *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 115-119 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

An aerodynamic program for steady supersonic linearized potential flow using a higher order panel method was developed. Boundary surface is divided into planar triangular panels on each of which a linearly varying doublet and a constant or linearly varying source are distributed. Distributions of source and doublet on the panel assemblies of the panels can be determined by their strengths at nodal points, which are placed at the vertices of the panels for linear distribution or on each panel for constant distribution. The fact that the trend of the results is just the same as that of the Pan Air pilot code suggests equivalent computations are done by both programs, though the former scheme is much simpler than the latter. Author

N87-14262# National Aerospace Lab., Tokyo (Japan).
SOME NUMERICAL CALCULATIONS BY USING LINEAR CLASSICAL SONIC THEORIES APPROACHED FROM SUB- OR SUPERSONIC SPEEDS
Yuzo Yamamoto and Shigenori Ando *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 121-129 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Unsteady aerodynamics of a two-dimensional wing at sonic speed are studied by using so-called classical sonic theories (linear), approached from supersonic flow (M = 1 + 0) or subsonic flow (M = 1 - 0). In the former approach, the exact expressions of lift and lift distribution are obtained in terms of Fresnel integrals, while in the latter approach an integral equation must be solved, the kernel function of which is obtained from the subsonic Possio's equation and has a root singularity. The discrete analysis is adopted on the basis of the semi-circle method (SCM) and the weighting function for subsonic-flow-Gauss-quadrature, as well as modified diagonal elements resulting from the root singularity. Aerodynamic characteristics obtained from both approaches agree quite well with each other. The results obtained by the present computations are compared with those of DLM-C (subsonic 2D code) developed by ANDO et al, and are found to give a reasonable outer boundary for subsonic unsteady aerodynamics. Author

N87-14263# National Aerospace Lab., Tokyo (Japan).
APPLICATION OF THE e SUP N METHOD TO CALCULATIONS OF LAMINAR FLOW CONTROL **c34**
Yoji Ishida and Nobutake Itoh *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 131-138 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

The e sup N method was applied to two-dimensional, incompressible laminar boundary layers with and without suction with the aim of developing an aerodynamic design method for a laminar flow control airfoil. The method consisted of an airfoil, boundary layer and e sup N codes, respectively. The airfoil code used the vortex singularity method and the boundary layer code Keller's Box method. In the e sup N code, the Orr-Sommerfeld equation was solved spatially with a given fundamental flow by the Itoh method and the growth rate (alpha sub i) was integrated from the neutral point to an arbitrary downstream point, which gave the total amplification of the disturbance. A transition point was predicted by the point at which the total amplification became e sup N. As an example of the calculation, the laminar boundary layer over the surface of the NACA0012 airfoil with the suction velocity determined by the Michel criterion which could maintain the laminar flow over a full chord length was tested to confirm the very strong stabilizing effect of the suction. The result showed that both the Michel and the e sup N methods agree well qualitatively, but some uncertainty remains about quantitative agreement. Author

N87-14264# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONAL STUDY OF FLOW IN CURVED PIPES WITH CIRCULAR-SECTION **c34**
Susumu Shirayama, Tetsuya Kawamura, and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 139-146 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

By solving the incompressible Navier-Stokes equations the flow field is calculated in a circular-sectioned pipe with a straight inlet or gradually enlarged inlet in the higher Dean number. With the straight inlet, a secondary flow of cross stream planes was obtained and with the higher Dean number some different flow patterns were obtained. With the gradually enlarged inlet, the difference of flow patterns corresponding to Reynolds number could be simulated. Author

N87-14265# National Aerospace Lab., Tokyo (Japan).
EFFECTS OF BOUNDARY CONDITIONS IN NUMERICAL EXPERIMENTS FOR TURBULENT FLOWS **c34**
Toshio Kobayashi and Kozo Kitoh *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 147-151 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

With the increase of computer speed and capacity, the numerical prediction method, which was developed mainly in the field of aircraft technology, is gradually being applied to automotive aerodynamics. However, the large wake behind a road vehicle necessitates more elaborate computational techniques for the selection of turbulence model and boundary condition. The effects of boundary conditions on the numerical turbulent flow around a road vehicle are preliminarily analyzed using the finite difference method and the kappa - epsilon model. It is found from the calculations that the stability and behavior of numerical solution depends strongly on the boundary conditions of turbulence energy and dissipation. Author

N87-14266# National Aerospace Lab., Tokyo (Japan).
NUMERICAL SIMULATION OF TRANSONIC FLOW FIELDS BY SOLVING THE THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS
Kozo Fujii, Masahiro Yoshida, and Shigeru Obayashi *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 159-165 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

The LU-ADI factored scheme was successfully applied to solving the three-dimensional compressible thin-layer Navier-Stokes equations. The computations were performed for the slightly supersonic flow over a hemispheric cylinder at high incidence and for the transonic flow over a swept wing. To simulate these complicated flow fields, fine grid distributions up to about 200,000 points were used on a Japanese supercomputer. The total cpu time for each case was less than two hours. The result for the flow over a hemispheric cylinder at high incidence revealed the existence of the shock wave and the detailed structure of the vortical flow field on the leeward side. The improved version of

the LU-ADI scheme was then developed and used for the simulation of the viscous transonic flow fields over the main wing of a practical transportation aircraft. Excellent agreement was obtained between the calculated pressure distribution over the surface and that of the experiment. The three-dimensional complicated separation phenomenon was also revealed for the case of relatively high angle of attack. These results indicate the capability of the present code to simulate three-dimensional complicated flow fields. The application of the present code to more practical flow fields such as transonic flows over a wing-body combination of transportation is very promising. Even simulation over the whole aircraft geometry may soon be possible. Author

N87-14267# National Aerospace Lab., Tokyo (Japan).
THE RELIABILITY OF NUMERICAL SOLUTIONS FOR THE VISCOUS TRANSONIC FLOWS OVER AN AIRFOIL
Kisa Matsushima, Shigeru Obayashi, and Kozo Fujii *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 167-173 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

The transonic viscous flow field about an airfoil was computed using the LU-ADI algorithm. Several kinds of grid distribution were examined to evaluate the effect of the grid spacing and the orthogonality near the body surface. The computed results indicate that good representation of the geometry is very important for finite difference computation. The grid orthogonality is also important. The grid spacing should be small where the flow variable changes rapidly and conventional use of the grid does not suffice. Grid points near the boundary layer edge should also be carefully distributed. Author

N87-14268# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONAL STUDY OF FLOW AROUND AN AIRFOIL AT HIGH ANGLES OF ATTACK BY A BLOCK PENTADIAGONAL MATRIX METHOD
Yoshifumi Shida and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 175-184 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Two unsteady flows around an airfoil are studied by numerically solving the two-dimensional compressible Navier-Stokes equations. One is the flow around a NACA0012 airfoil at Mach 0.4 at an angle of attack of 15 degrees. The Reynolds number is 1000000. The other is the dynamic stall problem around a NACA0012 airfoil. The Mach number is 0.3. The Reynolds number is 4000000. The block pentadiagonal matrix scheme, a method which is based on the approximate factorization scheme, is adopted. In the former case, a strong suction peak is observed near the leading edge in the computational results obtained by using a fine meah. It appeared to be maintained by turbulence-like small vortices. In the case of the dynamic stall, two noteworthy features are observed in the computation using the fine mesh. The first is that when vortex separation occurs on the upstroke, many small vortices are separated from all parts of the surface, rather than just one large vortex from the leading edge as one might expect. The second is that the flow re-attaches when the angle of attack is about 8 degrees on the down-stroke. The lift stall is cleanly captured in this study. Author

N87-14269# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONS OF TWO- AND THREE-DIMENSIONAL FLOWS USING AN ADAPTIVE MESH **c34**
Kazuhiro Nakahashi *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 197-207 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Two- and three-dimensional, steady and unsteady viscous flow fields are numerically simulated by solving the Navier-Stokes equations. A solution-adaptive-grid method is used to redistribute the grid points so as to improve the resolution of shock waves and shear layers without increasing the number of grid points. Flow fields considered include two-dimensional transonic flows about airfoils, two- and three-dimensional supersonic flow past an aerodynamic afterbody with a propulsive jet, supersonic flow over a blunt fin mounted on a wall, and supersonic flow over a bump. The computed results demonstrate a significant improvement in accuracy and quality of the solutions owing to the solution-adaptive mesh. Author

N87-14270# National Aerospace Lab., Tokyo (Japan).
DIRECT NUMERICAL CONTROL IN GRID GENERATION **c64**
Yoshiaki Kodama *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 209-216 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

A grid generation scheme is proposed. In this scheme, several plausible geometrical conditions which should be satisfied by a grid are listed, and then, starting with an initial grid, modifications are made iteratively to the grid, until those conditions are satisfied. The present scheme is called a geometrical method, in contrast to the existing algebraic and partial differential equation approaches. The geometricl conditions listed in the 2-D case are: clustering in the eta-direction; orthogonalization near the solid wall; smooth spacing distributuion in the xi-direction; smooth spacing distribution in the eta-direction; smooth curvature distribution in the eta-direction; smooth curvature in the xi-direction; minimum spacing in the xi-direction; and minimum spacing in the eta-direction. The conditions are realized by simple algorithms, and are combined with suitable weighting factors. Several examples of 2-D geometries are shown, such as a NACA0012 wing section with angle of attack, a NACA0012 wing section with a spoiler and a flap, and a circular cylinder both for C-grid and O-grid. Extension to 3-D is straightforward and will soon be published. Author

N87-14271# National Aerospace Lab., Tokyo (Japan).
TWO-DIMENSIONAL INCOMPRESSIBLE FLOWS AROUND AN AIRFOIL AT SEVERAL ATTACK ANGLES
Yoshiaki Nakamura, Mitsuo Ishiguro, and Michiru Yasuhara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 217-227 In JAPANESE; ENGLSH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Two-dimensional incompressible flows were numerically solved for two problems, using stream function-vorticity formulation with second-order accuracy in space and first-order accuracy in time. First, flows around an NACA0012 airfoil were solved at a Reynolds number of 10000 at angles of attack up to 15. Separation and generation of vortices were well simulated. Secondly, this method was applied to a flow around a circulation controlled airfoil, where a jet was emitted along the airfoil surface. The result indicates that outside the jet near the trailing edge the flow is deflected downward and that vortices play a significant role at the initial stage. Author

N87-14272# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONAL STUDY OF THREE-DIMENSIONAL WAKE STRUCTURE
Ryutaro Himeno, Susumu Shirayama, Keisuke Kamo, and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 229-234 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Three-dimensional wake structure is studied by numerically solving the incompressible Navier-Stokes equations. The results are visualized by a three-dimensional color graphic system. It was found that a pair of vortex tubes separated from the body plays the most important role in the wake. Near the body the vortex tubes are rather stable; as they flow downstream they gradually become unsteady. Author

N87-14273# National Aerospace Lab., Tokyo (Japan).
TRANSONIC AILERON COMPUTATION IN COMPARISON TO WIND TUNNEL TEST
Junichi Miyakawa, Naoki Hirose, and Nobuhiro Kawai *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 235-241 In JAPNAESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

The progress of computational aerodynamics over the past decade was so tremendous, partly pushed by the rapid advance in computer hardware, that aircraft designers have obtained an alternative tool for aerodynamic analysis comparable to wind tunnel testing. The Navier-Stokes computation, which was used successfully in research recently, is also likely to become a practical tool for analyzing viscous flows. NSFOIL, the high Reynolds number transonic airfoil analysis code developed at NAL, was verified by comparing it with the results of high Reynolds number wind tunnel tests. The NSFOIL computation of the transonic airfoil with aileron, is presented. To show the effectiveness of this code, the comparison of numerical results with the experiment is also presented. Author

N87-14274# National Aerospace Lab., Tokyo (Japan).
INVESTIGATION OF A PREDICTION METHOD OF TRANSONIC FLUTTER CHARACTERISTICS USING UNSTEADY TRANSONIC AERODYNAMICS c08
Haruhiko Arakawa, Hideki Nomoto, Nobuo Toda, and Kouichi Hiraoka *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 243-249 In JAPNAESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Theoretical studies to predict aircraft transonic flutter phenomena are reviewed and a practical method based on nonlinear transonic aerodynamic is proposed for estimating flutter characteristics of aircraft in their initial design phase. This analytical tool consists of two and three dimensional subsonic aerodynamic calculations corrected by two dimensional transonic aerodynamic computations to account for the shock movement on the wing surface. The present analytical procedure is fairly good at predicting the flutter characteristics of the wing wind tunnel flutter test model of the YXX, the next commercial transport currently under study. This result indicates the wide applicability of the method to the flutter estimation of aircraft with high aspect ratio wings. Author

N87-14275# National Aerospace Lab., Tokyo (Japan).
TRANSONIC WING AND AIRFOIL DESIGN USING INVERSE CODE WINDES c05
Susumu Takanashi *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 251-256 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

An iterative design procedure is presented for two- and three-dimensional transonic wings with prescribed (target) pressure distribtuions. The inverse code WINDES is used in combination with existing flow analysis codes in the iterative design method. The iteration proceeds in the following steps: First, the flow field is solved for an initially assumed wing by an analysis code. Next, WINDES is operated, which provides the approximate amount of wing geometry correction needed to compensate for the difference between the computed and the target pressure distributions. Consequently a new wing is obtained which can be used again as the input data for the analysisi code. The same process is repeated until convergence is achieved. The advantage of the present approach is that the analysis code is retained in its original form and therfore can be treated as a black box. The adoption of several analysis codes for potential, Euler, and Navier-Stokes equations was successfully applied to transonic design problem. Author

N87-14276# National Aerospace Lab., Tokyo (Japan).
APPLICATION OF COMPUTATIONAL AERODYNAMICS TO WING DESIGN UNDER FUSELAGE INTERFERENCE c05
Shogo Hirano and Norihiro Shinokawa *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 257-265 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Recent progress in computational aerodynamics has enabled the engineers of aircraft manufacturers to utilize transonic aerodynamic analysis programs in designing wings. Application of computer codes to the wing-body combination study of transonic transport aircraft is introduced. The computational results are compared with wind-tunnel test data. The problems of the present analysis program and the capabilities required in future programs are also presented. Author

N87-14277# National Aerospace Lab., Tokyo (Japan).
THE ROLE OF COMPUTATIONAL FLUID DYNAMICS IN AERONAUTICAL ENGINEERING: THIRD REPORT c05
Toru Nohisa, Takashi Uchida, Tadamasa Jyonouchi, and Keisuke Sawada *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 267-276 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

Recently, a flow analysis based on the Euler/Navier-Stokes equations has become more important and necessary in aerodynamic design. Therefore codes, based on the Beam-Warming-Steger (2-D, axisymmetric) method, were developed in KHI to solve the Euler/Navier-Stokes (thin-layer) equations. So far the calculation time required to get the final result is too long and the codes lack robustness. Some attempts were made to improve them. Presented are: comparison of some calculation results of the KHI Euler code with Jameson's FLO 54; application of the multigrid method and the local-variable-time-step method to KHI Euler code (these applications shorten the time steps needed for convergence); and some of the results obtained with KHI's Navier-Stokes code. Author

N87-14278*# Iowa State Univ. of Science and Technology, Ames. College of Engineering.
WING/BODY INTERFERENCE FLOW INVESTIGATION Ph.D. Thesis. Final Technical Report
Jerald M. Vogel and M. Gawad Nagati 1986 112 p
(Contract NCC2-19; ERI Proj. 1432)
(NASA-CR-179979; NAS 1.26:179979) Avail: NTIS HC A06/MF A01 CSCL 51A

The concept of using parametric bicubic patch surface definitions with bilinear vorticity or biquadratic doublet distributions was tested by modeling the vortex sheet and predicting its shape numerically in the vicinity of the wing. For the purpose of computing induced velocities, it was shown that higher order of vorticity would not improve the truncation error. The bilinear distribution, used to model the tip vorticity, was satisfactory but gave rise to some difficulty. The bicubic geometric surface representation proved very suitable for curved surfaces such as the rolled-up vortex sheet, with the surface fit scheme failing only for complex wings, far downstream beyond the region of concern. B.G.

N87-14279*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A VERIFICATION OF UNSTEADY NAVIER-STOKES SOLUTIONS AROUND OSCILLATING AIRFOILS
Jiro Nakamichi Sep. 1986 31 p
(NASA-TM-88341; A-86337; NAS 1.15:88341) Avail: NTIS HC A03/MF A01 CSCL 51A

A finite difference solution code for the two dimensional Navier-Stokes equations was combined with a moving-grid system. The thin layer Navier-Stokes equations with a turbulence model are solved in a time-accurate manner in order to study the unsteady aerodynamics around airfoils undergoing small amplitude pitching or heaving motions in the transonic regime. The accuracy of the solutions obtained by the use of the present moving-grid technqiue is investigated. The effects of the minimum grid size and the integrating time-step size on the solutions are also checked. Some of the solutions obtained by the present

method are compared with experimental results. It is demonstrated that the unsteady aerodynamics around oscillating airfoils can be predicted fairly well by the present code for cases in which the dynamic angle of attack or displacement is small. Author

N87-14280*# National Aeronautics and Space Administration, Washington, D.C.
AERODYNAMIC CHARACTERISTICS OF GENERAL AVIATION AT HIGH ANGLE OF ATTACK WITH THE PROPELLER SLIP-STREAM
N. Matsuo and S. Hirano Sep. 1986 21 p Transl. into ENGLISH from Japan Society for Aeronautical and Space Sciences Journal, v. 33, no. 377, Jun. 1985 p 326-332 Original language document was announced in IAA as A86-25204 Transl. by Kanner (Leo) Associates, Redwood, City, Calif.
(Contract NASw-4005)
(NASA-TM-88503; NAS 1.15:88503; ISSN-0021-4663) Avail: NTIS HC A02/MF A01 CSCL 51A

The aerodynamic characteristics of the FA-300 business aircraft at high angle of attack with the propeller stream are described. The FA-300 offers two types, FA-300-700 for 340 HP, and -710 for 450 Hp of the engine. The effects of the propeller slipstream on the high angle of the attack are discussed. Author

N87-14281*# National Aeronautics and Space Administration, Washington, D.C.
VORTEX SYSTEMS ON SLENDER ROTATING BODIES AND THEIR EFFECT ON THE AERODYNAMIC COEFFICIENTS
M. Fiechter Dec. 1986 50 p Transl. into ENGLISH of "Uber Wirbelsysteme an Schlanken Rotationskoerpern und Ihren Einfluss auf die Aerodynamischen Beiwerte" Deutsch-Franzoesisches Forschungsinstitut (Saint-Louis, France), p 1-54 Translation was announced as N68-29391 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(NASA-TM-88490; NAS 1.15:88490; ISL-10/66) Avail: NTIS HC A03/MF A01 CSCL 51A

The turbulent flow of rotational bodies up to a length of 20 diameters with various head shapes and cylindrical tails was examined in the subsonic wind tunnel with the Mach number of M = 0.1. At angles of incidence lower than 30 degrees, a pair of symmetrical eddies rests stationary from head to tail on the trailing side, very close to the body. At angles between 30 and 60 degrees, the stationary eddies are asymmetrically pushed off. Between 60 and 90 degrees, the eddies detach themselves in an instationary manner. This includes, for example, the turbulent flow at the start-up of flying bodies in the presence of lateral winds. The results of measurments obtained by Mello at M = 2, an impulse method, and the cross flow theory according to Allen are used for comparison. Author

N87-14282*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH LIFT, LOW PITCHING MOMENT AIRFOILS Patent Application
Kevin W. Noonan, inventor (to NASA) Filed 5 Sep. 1986 30 p
(NASA-Case-LAR-13215-1; NAS 1.71:LAR-13215-1;
US-Patent-Appl-SN-904132) Avail: NTIS HC A03/MF A01 CSCL 51A

Two families of airfoil sections which can be used for helicopter/rotorcraft rotor blades or aircraft propellers of a particular shape are prepared. An airfoil of either family is one which could be produced by the combination of a camber line and a thickness distribution or a thickness distribution which is scaled from these. An airfoil of either family has a unique and improved aerodynamic performance. The airfoils of either family are intended for use as inboard sections of a helicopter rotor blade or an aircraft propeller. The novelty appears to reside in the specific shapes of the airfoil profiles which simultaneously permit high maximum lift coefficients at Mach numbers up to 0.50, low pitching moment coefficients about the quarter chord for lift coefficients from -0.2 to 1.0 at Mach numbers up to 0.63, and high drag divergence Mach numbers at lift coefficients from 0.0 to 0.30. NASA

N87-14283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPATIALLY GROWING DISTURBANCES IN A HIGH VELOCITY RATIO TWO-STREAM, COPLANAR JET
Jeffrey H. Miles 1987 12 p Presented at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(NASA-TM-88922; E-3255; NAS 1.15:88922; AIAA-87-0056) Avail: NTIS HC A02/MF A01 CSCL 51A

The influence of cold and heated secondary flow on the instability of a two-stream, coplanar jet having a 0.7 Mach number heated primary jet for a nominal fan to primary velocity ratio of 0.68 was investigated by means of inviscid linearized stability theory. The instability properties of spatially growing axisymmetric and first order azimuthal disturbances were studied. The instability characteristics of the two-stream jet with a velocity ratio of 0.68 are very different from those of a single stream jet, and a two-stream, coplanar jet having a 0.9 Mach number heated primary jet and a cold secondary jet for a fan to primary velocity ratio of 0.30. For X/D = 1 and in comparison to the case where the velocity ratio was 0.3, the presence of the fan stream with a velocity ratio of 0.68 enhanced the instability of the jet and increased the unstable frequency range. However, the axisymmetric mode (m = 0) and the first order azimuthal mode (m = 1) have similar spatial growth rates where the velocity ratio is 0.68 while for a velocity ratio of 0.3 the growth rate of the first order azimuthal mode (m = 1) is greater. Comparing the cold and hot secondary flow results showed that for a velocity ratio of 0.68 the growth rate is greater for cold. Author

N87-14284*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPAGATION OF SOUND WAVES IN TUBES OF NONCIRCULAR CROSS SECTION
W. Bruce Richards (Oberlin Coll., Ohio) Aug. 1986 33 p
(NASA-TP-2601; E-2690; NAS 1.60:2601) Avail: NTIS HC A03/MF A01 CSCL 01A

Plane-acoustic-wave propagation in small tubes with a cross section in the shape of a flattened oval is described. Theoretical descriptions of a plane wave propagating in a tube with circular cross section and between a pair of infinite parallel plates, including viscous and thermal damping, are expressed in similar form. For a wide range of useful duct sizes, the propagation constant (whose real and imaginary parts are the amplitude attenuation rate and the wave number, respectively) is very nearly the same function of frequency for both cases if the radius of the circular tube is the same as the distance between the parallel plates. This suggests that either a circular-cross-section model or a flat-plate model can be used to calculate wave propagation in flat-oval tubing, or any other shape tubing, if its size is expressed in terms of an equivalent radius, given by g = 2 x (cross-sectional area)/(length of perimeter). Measurements of the frequency response of two sections of flat-oval tubing agree with calculations based on this idea. Flat-plate formulas are derived, the use of transmission-line matrices for calculations of plane waves in compound systems of ducts is described, and examples of computer programs written to carry out the calculations are shown. Author

N87-14285# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
TURBULENCE MODELING FOR STEADY THREE-DIMENSIONAL SUPERSONIC FLOWS Final Report
James E. Danberg, Paul VanGulick, and Jin Kim Jun. 1986 63 p Sponsored by BRL
(AD-A170042; BRL-CR-553) Avail: NTIS HC A04/MF A01 CSCL 20/4

The Jones and Launder two-equation model of turbulence has been formulated and applied to the solution of supersonic, three-dimensional flow and the results compared to experimental data. Two solution techniques were studied, the boundary layer theory approach and the parabolized Navier-Stokes method formulated in a body fitted coordinate system. The K-E turbulence model results were compared with an algebraic turbulence model

as applied to the prediction of flow about a spinning ogive-cylinder-boattail configuration. The K-E model gave slightly superior results in both the boundary layer and PNS computations. Rotta's non-isotropic theory for the Reynolds stresses was incorporated into the formulation. Results for the small angle of attack configuration showed little effect of non-isotropy. The cross flow properties are the most strongly affected. Bradshaw's streamline curvature theory was also considered and the results show negligible influence for the present case. GRA

N87-14286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ACTA AERONAUTICA ET ASTRONAUTICA SINICA (SELECTED ARTICLES)

Tian Xueshi, Li Xiangrui, Zhao Jincheng, Xin Dingding, and Deng Xueying 11 Jul. 1986 112 p Transl. into ENGLISH from Hang Kong Xuebao (China), v. 5, no. 4, 1984 p 357-405

(AD-A170157; FTD-ID(RS)T-1264-85) Avail: NTIS HC A06/MF A01 CSCL 20/4

Topics addressed include: wind tunnel experiments; turbulent boundary layers; multicolor flow field survery technique; hydrogen bubble method; turbulent separated flow; boundary layer transistion; and hot-film gages. B.G.

N87-14287# Grenoble-1 Univ. (France). Inst. de Mecanique.

CAVITATION RESEARCH. CAVITATION DEVELOPED AND BOUNDARY LAYERS FOR THE NACA 16-012 PROFILE WITH OSCILLATING INCIDENCE [RECHERCHES EN CAVITATION. CAVITATION DEVELOPPEE ET COUCHE LIMITE SUR PROFIL NACA 16-012 OSCILLANT EN INCIDENCE]

J.-P. Franc and J.-M. Michel Apr. 1985 93 p In FRENCH

(Contract DRET-81-513)

(ETN-86-98436) Avail: NTIS HC A05/MF A01

Wing flow visualization and a computation procedure are reported. The oscillating apparatus allowed 5 deg amplitude for incidences adjustable between -10 to +10 deg and frequencies up to 25 Hz. The visualization is obtained by dye injection near the leading edge, filmed using highly sensitive color film. The results are presented as space-time diagrams. The computation procedure refers to a noncavitating unsteady flow. The results show the computation feasibility and the similarity of computed and visualized flows. ESA

N87-14288# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

SIMPROP: A SYSTEM FOR SIMPLE AERODYNAMIC ANALYSIS OF PROPELLERS IN AXIAL FLOW. DESCRIPTION OF METHOD AND USER'S GUIDE

Th. E. Labrujere and A. Kassies 31 Dec. 1984 46 p

(Contract NIVR-1968)

(NLR-TR-84128-U; B8671295; ETN-86-98651) Avail: NTIS HC A03/MF A01

A program system (SIMPROP) for simple aerodynamic analysis of propellers in axially symmetric flow is described. A vortex and a momentum method, both based on trip theory, are used for the calculation of induced velocities. The required two dimensional airfoil characteristics are obtained by computer programs based on finite difference methods for the calculation of viscous transonic flow. Numerical results agree with measured data. ESA

N87-14289# European Space Agency, Paris (France).

INVESTIGATION OF FERRI INSTABILITY IN SUPERSONIC INLETS

Ernst-Otto Krohn and Klaus Triesch Jun. 1986 32 p Original language document was announced as N86-21524

(ESA-TT-978; DFVLR-FB-85-53; ETN-87-98825) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany, DM 13

Ferri instability, caused by the inflow of a discontinuity surface (slipline) in the inlet was studied. A criterion for the appearance of the Ferri instability was derived. Flat inlets are most, and semirotationsymmetric inlet the least, sensitive to Ferri instability. Means to avoid the instability are discussed. Strength and penetration depth of the slipline play a role in triggering the instability, although this role is not clarified. ESA

N87-14290# European Space Agency, Paris (France).

FLOW FIELD MEASUREMENTS IN THE 3M X 3M LOW SPEED WIND TUNNEL (NWG) OF THE DFVLR IN GOETTINGEN (WEST GERMANY)

Arnulf Kuehn May 1986 62 p Original language document was announced as N86-21558

(ESA-TT-981; DFVLR-Mitt-85-14; ETN-87-98826) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 25

A ten-hole probe was developed for flow field measurements in a low speed wind tunnel. The probe allows the determination of the total and static pressures as well as the local direction in a flow field. Mechanical design, calibration procedure, and control system are described. The probe is moved in the wind tunnel by a three-dimensional displacement mechanism. The data acquisition and reduction system, and the presentation of results are described. The accuracy of the flow direction measurements is discussed. ESA

N87-14291# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Hauptabteilung Windkanaele.

EXPERIENCE ABOUT THE APPLICATION AND VALUATION OF ROUGHNESS STRIPS FOR BOUNDARY LAYER TRANSITION CONTROL IN WIND TUNNEL TESTS IN THE HIGH-SPEED RANGE

Sieghard Tusche Apr. 1986 91 p In GERMAN; ENGLISH summary

(DFVLR-Mitt-86-12; ISSN-0176-7739; ETN-87-98852) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 56

Placing and application of artificial transition strips for aerodynamic tests are described. Methods used in high speed wind tunnels for checking the effectiveness of transition strips are given. ESA

N87-14292# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Trans-Ueberschall-Entwurfsverfahren.

A CALCULATION METHOD FOR THE PROPULSIVE JET AND ITS AERODYNAMIC INTERACTION WITH AN AFTERBODY Ph.D. Thesis - Technische Univ., Brunswick, West Germany

Rolf Radespiel Jun. 1986 117 p In GERMAN; ENGLISH summary

(DFVLR-FB-86-29; ISSN-0171-1342; ETN-87-98858) Avail: NTIS HC A06/MF A01

A calculation method for single and multistream jet flows and their aerodynamic interaction with an afterbody is developed. The governing equations of viscous and inviscid flow fields are given in natural coordinates of the viscous flow. A transpiration model takes into account the viscous inviscid interactions. Reynolds stresses and turbulent heat fluxes are calculated using kinetic energy, dissipation rate, and intermittency factor of turbulence. The calculation method is applied on classical boundary layer flows, then verified by calculations of flows around afterbodies with single and two stream jets. ESA

N87-14293# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

INVESTIGATIONS OF THE WAKE IN A FLOW PARALLEL TO PLATES WITH BLUNT TRAILING EDGES Thesis [UNTERSUCHUNGEN DES NACHLAUFS LAENGSANGESTROEMTER PLATTEN MIT STUMPFER HINTERKANTE]

H. Eisenlohr Feb. 1986 75 p In GERMAN

(MPIS-3/1986; ISSN-0436-1199; ETN-87-98865) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21

The wake flow along a plate with straight trailing edges was investigated in a wind tunnel for low Mach numbers in order to improve the interaction between the different regions in the flow, and to verify model calculations. The measurements determine

the dependence of the Strouhal number on the Reynolds number, whereby a characteristic length was chosen. The velocity distributions at different distances from the edges show vortex initiation, vortex streets and decay initiation. The large influence range of the plate edges is remarkable. Vortex branching occurs for strong vortex axis curvatures. Proposals for further investigation of the branching processes are given. ESA

N87-14294# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SHOCK OSCILLATIONS IN TRANSONIC NOZZLE FLOWS [STOSSSCHWINGUNGEN IN TRANSSONISCHEN DUESENSTROEMUNGEN]
M. Rein, G. Grabitz, and G. E. A. Meier May 1986 24 p In GERMAN
(MPIS-7/1986; ISSN-0436-1199; ETN-87-98867) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13

The effect of a sinusoidal perturbation of the end pressure on the shock terminating the supersonic domain was numerically investigated for transonic inviscid nozzle flows using the method of characteristics. The shock motion is approximately sinusoidal for low amplitudes and frequencies, while at higher frequencies complicated shock motions occur; new shocks develop, and several shocks can simultaneously exist. At higher amplitudes of the pressure perturbation, a simple oscillation of the shock around a steady position cannot exist at lower frequencies since a new shock develops in each period. End pressure perturbations of different frequencies are superposed; the calculated shock motions are no longer regular in such a case. Complex unsteady flow patterns in transonic nozzle flow can be gas-dynamically modelled with a simple numerical computation which does not take into account friction effects. ESA

N87-14295# European Space Agency, Paris (France).
DIRECT CALCULATION OF WALL INTERFERENCES AND WALL ADAPTATION FOR TWO-DIMENSIONAL FLOW IN WIND TUNNELS WITH CLOSED WALLS
Jochen Amecke Sep. 1986 103 p Original language document was announced as N86-28065
(ESA-TT-989; DFVLR-FB-85-62; ETN-87-98891) Avail: NTIS HC A06/MF A01; original German version available from DFVLR, Cologne, West Germany DM 29

A method for the direct calculation of the wall-induced interference velocity in two-dimensional flow based on Gauchy's integral formula was derived. This one-step method allows the calculation of the residual corrections and the required wall adaptation for interference-free flow starting from the wall pressure distribution without any model representation. Applications are demonstrated. ESA

N87-14337# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
MULTIDIMENSIONAL SUPERSONIC FLOW WITH SUPPLY OF HEAT [MEHRDIMENSIONALE UEBERSCHALLSTROEMUNG MIT WAERMEZUFUHR]
Karl Foerster *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 153-162 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14340# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
DESIGN OF PROFILES FOR CASCADES [PROFILENTWURF FUER GITTER]
Lars Goettsching *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 243-267 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14342# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
SUPERCRITICAL BLADE CASCADE DESIGN [ENTWURF SUPERKRITISCHER SCHAUFELGITTER]
Ekkehard Schmidt *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 283-326 In GERMAN Previously announced as N83-34834 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14343# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
CALCULATION AND ANALYSIS OF CHEMICALLY REACTING SUPERSONIC FLOWS [BERECHNUNG UND ANALYSE CHEMISCH REAGIERENDER UEBERSCHALLSTROEMUNGEN]
Johannes Algermissen *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 327-336 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14636# Royal Aircraft Establishment, Farnborough (England).
MODELING THREE DIMENSIONAL VORTEX FLOW IN AERODYNAMICS
J. H. B. Smith *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 67 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

N87-14640# National Aerospace Lab., Amsterdam (Netherlands).
NUMERICAL SIMULATION OF VORTICAL FLOW
H. W. M. Hoeijmakers *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 149 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

N87-14641# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBILITY EFFECTS ON DELTA WING FLOW FIELDS
G. Vorropoulos and John F. Wendt *In its* Introduction to Vortex Dynamics, Volume 2 1986 36 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

N87-14642# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBILITY EFFECTS ON FLOWS AROUND SIMPLE COMPONENTS
John F. Wendt *In its* Introduction to Vortex Dynamics, Volume 2 1986 21 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

N87-14643# Naval Academy, Annapolis, Md.
MEASUREMENTS OF THE IMPINGEMENT OF A VORTEX FLOW ON A CONTROL SURFACE BY 3D LASER VELOCIMETRY
Joseph Gillerlain and W. J. Yanta *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 17 p Sponsored by the Naval Air Systems Command (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N87-14296 Civil Aviation Authority, London (England). Safety Data and Analysis Unit.
ANALYSIS OF BIRD STRIKES REPORTED BY EUROPEAN AIRLINES 1976-1980. CIVIL AIRCRAFT OVER 5700 kG (12 500 LB) MAXIMUM WEIGHT
J. Thorpe Dec. 1984 30 p
(CAA-Paper-84019; ISBN-0-86039-231-7; ETN-87-98597)
Copyright. Avail: Issuing Activity

Over 7300 bird strikes reported world-wide between 1976 and

1980 by European airlines from 14 countries were analyzed. The analysis includes the annual strike rate for each country, for aircraft types, and airports, all based on aircraft movements. It also covers bird species and weights, part of aircraft struck, effect of strike, and cost. Results show that gulls were involved in over 40% of the incidents where the type of bird was known, and that only 1% of bird strikes involves birds of over 4 lb. The major effects are damage to over 330 engines and the loss of a Boeing 737 and a Learjet (total value $6 million). Engineering costs are estimated at $17 million excluding the Boeing 737 and Learjet.
ESA

N87-14297 Civil Aviation Authority, London (England). Safety Data and Analysis Unit.
ACCIDENTS TO UK AIRCRAFT AND TO LARGE JET AND TURBO-PROP TRANSPORT AIRCRAFT WORLDWIDE IN 1984
Jun. 1985 25 p
(CAA-Paper-85009; ISBN-0-86039-241-4; ETN-87-98600)
Copyright. Avail: Issuing Activity

The 1984 accident statistics for all UK aircraft, all jet and turboprop airplanes of more than 5700 kg and all helicopters of more than 4500 kg worldwide are presented. A total of 99 accidents, of which 24 were fatal (369 deaths) is reported. ESA

N87-14298 Civil Aviation Authority, London (England).
HUMAN FACTORS IN ACCIDENTS DUE TO CONTROLLED FLIGHT INTO THE GROUND
Oct. 1985 14 p
(CAA-Paper-85015; ISBN-0-86039-258-9; ETN-87-98603)
Copyright. Avail: Issuing Activity

Accidents caused by large passenger carrying public transport aircraft inadvertently flying into the ground or water were analyzed. The lessons to be learned in the areas of human factors, and the benefits of airborne equipment (particularly ground proximity warning systems) are discussed. ESA

N87-14299 Civil Aviation Authority, London (England). Safety Data and Analysis Unit.
ANALYSIS OF BIRD STRIKES TO UNITED KINGDOM REGISTERED AIRCRAFT 1983 (CIVIL AIRCRAFT OVER 5700 kG MAXIMUM WEIGHT)
J. Thorpe Nov. 1985 21 p
(CAA-Paper-85018; ISBN-0-86039-264-3; ETN-87-98604)
Copyright. Avail: Issuing Activity

Bird strikes reported throughout the world in 1983 by UK airlines were analyzed. The analysis includes rates for aircraft type and operators reporting based on aircraft movements. It also covers aerodromes, bird species, and effect of strike. The reported strike rate in 1983 is the same as in 1982. Gulls (Larus spp.) were involved in 40% of incidents where the bird species were identified. The major effect is damage to 16 engines, with 9 cases of ingestion in more than one engine. ESA

N87-14300 Civil Aviation Authority, London (England).
WIND SHEAR AND FLIGHT SAFETY: A SELECT BIBLIOGRAPHY
Apr. 1986 41 p
(CAA-Paper-86003; ISBN-0-86039-279-1; ETN-87-98605)
Copyright. Avail: Issuing Activity

Almost 200 references covering wind shear and flight safety are listed. ESA

N87-14301 Civil Aviation Authority, London (England). Safety Data and Analysis Unit.
ACCIDENTS TO UNITED KINGDOM AIRCRAFT AND TO LARGE JET AND TURBO-PROP TRANSPORT AIRCRAFT WORLDWIDE IN 1985
May 1986 25 p
(CAA-Paper-86005; ISBN-0-86039-277-5; ISSN-0269-4948; ETN-87-98606) Copyright. Avail: Issuing Activity

The 1985 accident statistics for all UK aircraft, all jet and turboprop airplanes of more than 5700 kg and all helicopters of more than 4500 kg worldwide are presented. A total of 143 accidents, of which 42 were fatal (2033 deaths) is reported.
ESA

N87-14302 Civil Aviation Authority, London (England). Safety Data and Analysis Unit.
ANALYSIS OF BIRD STRIKES TO UNITED KINGDOM AIRCRAFT 1984 (CIVIL AIRCRAFT OVER 5700 kg MAXIMUM WEIGHT)
J. Thorpe Apr. 1986 20 p
(CAA-Paper-86006; ISBN-0-86039-274-0; ISSN-0269-4956; ETN-87-98607) Copyright. Avail: Issuing Activity

Bird strikes reported throughout the world in 1984 by UK airlines were analyzed. The analysis includes rates for aircraft types and operators reporting based on aircraft movements. It also covers aerodromes, bird species, and effect of strike. The reported strike rate in 1984 is the same as in 1983. Gulls (Larus spp.) were involved in 40% of incidents where the bird species were identified. The major effect is damage to 21 engines, with 5 cases of ingestion in more than one engine. ESA

N87-14303 Civil Aviation Authority, London (England). Medical Research Council Applied Psychology Unit.
AUDITORY WARNINGS ON THE BAC 1-11 AND THE BOEING 747. AN APPLICATION OF THE GUIDELINES OF CAA PAPER 82017 Final Report
Roy D. Patterson, Robert Milroy, and John Barton Feb. 1985 61 p
(Contract CAA-7D/S/0260/1)
(CAA-Paper-85004; ISBN-0-86039-234-1; ETN-87-98598) Avail: Issuing Activity

In order to verify the sound volume aspects of guidelines for the design of auditory warnings in aircraft two warnings in existing civil aircraft were assessed. One is frequently criticized as being too loud and the other as being too quiet. Neither warning is found to conform to the guidelines. ESA

N87-14304 Royal Air Force Inst. of Aviation Medicine, Farnborough (England). Aircrew Equipment Group.
EMERGENCY EXITS FOR UNDERWATER ESCAPE FROM ROTORCRAFT
J. R. Allan and F. R. C. Ward Jan. 1986 19 p
(AEG-Rept-528; BR98781; ETN-87-98622) Avail: NTIS HC A02/MF A01

An experimental adjustable escape exit was used to determine the smallest rectangular exit compatible with underwater escape by passengers in the upper range of shoulder widths and wearing standard immersion protection. An exit 432 mm (17 in) x 356 mm (14 in) is considered to be the smallest acceptable size. Recommendations in respect to swimming goggles, hand-holds, and opening systems, and for a review of the advantages of a larger number of smaller escape exits for ditching emergencies are made. ESA

N87-14305*# National Aeronautics and Space Administration, Washington, D.C.
ACCIDENT OF THE DC-10 EC-DEG AIRCRAFT AT MALAGA ON SEPTEMBER 13, 1982
Oct. 1986 18 p Transl. into ENGLISH from IAA/Ingenieria Aeronautica y Astronautica (Spain), Jan. 1986 p 24-31 Original language document was announced in IAA as A86-31011 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88007; NAS 1.15:88007; ISSN-0020-1006) Avail: NTIS HC A02/MF A01 CSCL 85D

The present analysis of the abortive takeoff-type accident of a DC-10 at Malaga airport gives attention to the velocity profiles of the aircraft from takeoff to ground impact. A fire followed ground impact. Takeoff was initiated by the crew with only 1295 m of runway left beneath the aircraft. On the basis of the data obtained by this analysis, it is recommended that both pilots and other flight crew members be trained to respond to takeoff failures due to causes other than loss of engine power, such as landing gear collapse. Author

N87-14306# Simula, Inc., Phoenix, Ariz.
COMPUTER SIMULATION OF A TRANSPORT AIRCRAFT SEAT AND OCCUPANT(S) IN A CRASH ENVIRONMENT, VOLUME 1 Final Report, Jun. 1983 - Mar. 1986
Akif O. Bolukbasi and David H. Laananen Aug. 1986 139 p
(Contract DTFA03-83-00036)
(DOT/FAA/CT-86/25-1; TR-84430-Vol-1) Avail: NTIS HC A07/MF A01

A mathematical model of a transport aircraft seat, occupants, and restraint system has been developed for use in analysis of transport aircraft crashworthiness. Because of the significant role played by the seat in overall system crashworthiness, a finite element model of the seat structure is included. The seat model can accommodate large plastic deformations and includes the capability for simulation of local buckling of bending members. Because the program was written for use primarily by engineers concerned with the design and analysis of seat and restraint systems, an effort was mac. to minimize the input data required to describe the occupant. This is Volume 1 of a two-volume document. This volume discusses development of the mathematical model of the occupants, the finite element seat analysis, validation, and organization of the computer program. Author

N87-14307# Simula, Inc., Phoenix, Ariz.
COMPUTER SIMULATION OF A TRANSPORT AIRCRAFT SEAT AND OCCUPANT(S) IN A CRASH ENVIRONMENT. VOLUME 2: PROGRAM SOM-TA USER MANUAL
Akif O. Bolukbasi and David H. Laananen Aug. 1986 211 p
(Contract DTFA03-83-C-0036)
(DOT/FAA/CT-86/25-2; TR-84429-Vol-2) Avail: NTIS HC A10/MF A01

A mathematical model of a transport aircraft seat, occupants, and restraint system was developed for use in analysis of transport aircraft crashworthiness. Because of the significant role played by the seat in overall system crashworthiness, a finite element model of the seat structure is included. The seat model can accommodate large plastic deformations and includes the capability for simulation of local buckling members. Because the program was written for use primarily by engineers concerned with the design and analysis of seat and restraint systems, an effort was made to minimize the input data required to describe the occupants. This is Volume 2 of a two-volume document. This volume contains instructions for preparing input data and operating the program, supported by detailed examples. Sample material properties and modeling parameters are also inlcuded. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications and Radar.*

N87-14308 Civil Aviation Authority, London (England). Air Traffic Control Evaluation Unit.
SURVEY OF TRACK KEEPING AND ALTITUDES ON HEATHROW AND GATWICK STANDARD INSTRUMENT DEPARTURE ROUTES
C. K. Townend Dec. 1984 82 p
(CAA-Paper-84018; ATCEU-511; ISBN-0-860-39-229-5; ETN-87-98596) Copyright. Avail: Issuing Activity

Track keeping of aircraft departing from Heathrow and Gatwick airports in relation to the published Standard Instrument Departure Routes was studied. The variations in aircraft lateral displacements and altitude at specific distances along each route are shown. ESA

N87-14309 Bundesanstalt fuer Flugsicherung, Frankfurt am Main (West Germany).
[ACTIVITIES REPORT IN AIR TRAFFIC CONTROL] Annual Report, 1985 [JAHRESBERICHT 1985]
Jun. 1986 54 p In GERMAN
(ETN-87-98861) Copyright. Avail: Issuing Activity

Developments in the aircraft and navigation fields including flight safety, flight accidents, and information systems are summarized. ESA

N87-14310*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF A PORTABLE PRECISION LANDING SYSTEM
Thomas J. Davis, George R. Clary, and Stanley L. MacDonald (Sierra Nevada Corp., Reno) Jul. 1986 21 p
(NASA-TM-88247; A-86227; NAS 1.15:88247) Avail: NTIS HC A02/MF A01 CSCL 76D

A portable, tactical approach guidance (PTAG) system, based on a novel, X-band, precision approach concept, was developed and flight tested as a part of NASA's Rotorcraft All-Weather Operations Research Program. The system is based on state-of-the-art X-band technology and digital processing techniques. The PTAG airborne hardware consists of an X-band receiver and a small microprocessor installed in conjunction with the aircraft instrument landing system (ILS) receiver. The microprocessor analyzes the X-band, PTAG pulses and outputs ILS compatible localizer and glide slope signals. The ground stations are inexpensive, portable units, each weighing less than 85 lb, including battery, that can be quickly deployed at a landing site. Results from the flight test program show that PTAG has a significant potential for providing tactical aircraft with low cost, portable, precision instrument approach capability. Author

N87-14311# Maryland Univ., College Park. Center for Automation Research.
AUTONOMOUS VEHICLE NAVIGATION Final Report, 1 Jan. 1983 - 31 Jan. 1986
Azriel Rosenfeld and Lary S. Davis May 1986 18 p
(Contracts DAAK70-83-K-0018; DARPA Order 3206)
(AD-A170379) Avail: NTIS HC A02/MF A01 CSCL 17/7

Research on Autonomous Vehicle Navigation, carried out during the period 1983 to 1985, his dealt primarily with the following areas: (1) Time-varying image analysis, (2) Stereo and range sensing, (3) 3D geometry and recognition, and (4) Tracking, visibility, and path planning. Author (GRA)

N87-14312# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
IMPLEMENTATION OF THE NUMERICAL ELECTROMAGNETIC CODE (NEC-2) FOR MODELING THE VOR (VERY-HIGH-FREQUENCY OMNI-DIRECTIONAL RANGE) NAVIGATION SYSTEM IN THE PRESENCE OF PARASITIC SCATTERERS M.S. Thesis
Paul R. Barre 13 Jun. 1986 111 p
(AD-A170669; AFIT/CI/NR-86-86T) Avail: NTIS HC A06/MF A01 CSCL 17/7

A computer model has been developed that estimates bearing error for a VOR airborne navigation system operating in the presence of small, parasitic scatterers such as antennas, antenna masts, and guy wires. This model, which is written using FORTRAN 77, interacts with an unmodified version of the Numerical Electromagnetics Code (NEC-2) to obtain the pertinent scattered-field data. These data are then used to calculate the composite field, and indicated bearing, at the airborne receiver location. Modeled results consist of plots of bearing error versus true bearing. Comparisons of modeled and measured data are presented. The azimuth angle of an aircraft with respect to a VOR station is determined by the phase of the received audio sinusoid generated by a limacon radiation pattern that rotates in space due to appropriate time varying phasing between four Alford loop antennas. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles see *85 Urban Technology and Transportation*.

N87-14313 Civil Aviation Authority, London (England).
REPORT OF THE WORKING GROUP ON HELICOPTER HEALTH MONITORING
Aug. 1985 93 p Presented at Recommendations of the Helicopter Airworthiness Review Panel (HARP), London, England
(CAA-Paper-85012; HARP-CAP-491; ISBN-0-86039-250-3; ETN-87-98601) Copyright. Avail: Issuing Activity

Proposed airworthiness requirements for future helicopters were studied to define the health monitoring improvements needed to realize the intended safety objectives. Results show that major benefits can be expected from exploiting health monitoring, not only on future helicopters, but also by retrospective application to those in service. Health monitoring is particularly relevant to the transmission, rotor systems, flight control system, and engines. Current technology can provide airworthiness and reliability benefits. Research or application developments required are listed. ESA

N87-14314* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REMOTE PIVOT DECOUPLER PYLON: WING/STORE FLUTTER SUPPRESSOR Patent
John M. Hassler, Jr., inventor (to NASA) (General Dynamics/Fort Worth, Tex.) Issued 14 Oct. 1986 7 p Filed 10 Jan. 1985 Supersedes N85-19981 (22 - 19, p 2996) Sponsored by NASA
(NASA-Case-LAR-13173-1; US-Patent-4,616,793; US-Patent-Appl-SN-690274; US-Patent-Class-244-137-A; US-Patent-Class-244-17.27; US-Patent-Class-244-118.1; US-Patent-Class-89-1.54; US-Patent-Class-248-638) Avail: US Patent and Trademark Office CSCL 01C

A device for suspending a store from an aerodynamic support surface, such an an aircraft wing, and more specifically, for improving upon singlet pivot decoupler pylons by reducing both frequency of active store, alignment, and alignment system space and power requirements. Two links suspend a lower pylon/rack section and releasable attached store from an upper pylon section mounted under the wing. The links allow the lower pylon section to rotate in pitch about a remote pivot point. A leaf spring connected between the lower section and electrical alignment system servomechanism provides pitch alignment of the lower section/store combination. The servomechanism utilizes an electric servomotor to drive the gear train and reversibly move the leaf spring, thereby maintaining the pitch attitude of the store within acceptable limits. The damper strokes when the lower section rotates to damp large oscillations of store.
Official Gazette of the U.S. Patent and Trademark Office

N87-14315# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
DOD (DEPARTMENT OF DEFENSE) ACQUISITION: CASE STUDY OF THE NAVY V-22 OSPREY JOINT VERTICAL LIFT AIRCRAFT PROGRAM
Jul. 1986 17 p
(PB86-231388; GAO/NSAID-86-45S-7) Avail: NTIS HC A02/MF A01 CSCL 01C

This study of the Joint Services Advanced Vertical Lift Aircraft Program describes the role of the program manager and contracting officer in developing the acquisition strategy. GRA

N87-14316 Royal Aircraft Establishment, Farnborough (England).
A METHOD FOR THE MANUFACTURE OF MODEL HELICOPTER ROTOR BLADES FROM GLASS FIBER REINFORCED PLASTIC
A. R. Lee Apr. 1985 27 p
(RAE-TR-85040; RAE-Mat/Struct-122; BR97931; ETN-86-98372) Avail: NTIS HC A03/MF A01

A method for constructing model helicopter rotor blades for a 24 ft wind tunnel rig was developed. Several methods for the manufacture of the blades, which have a glass fiber reinforced plastic (GFRP) spar and a balsa trailing edge section were evaluated. The advantages and disadvantages of each method are discussed, and the technique accepted for the blades used in wind tunnel tests is described. The technique uses laminated prepreg GFRP sheet for the spar and aluminum alloy female molds with an inflatable silicone rubber tube within the spar to consolidate the laminate. ESA

N87-14317*# National Aeronautics and Space Administration, Washington, D.C.
AN OVERVIEW OF THE BRITISH AEROSPACE HOTOL TRANSATMOSPHERIC VEHICLE
J. Mesnard Oct. 1986 7 p Transl. into ENGLISH from AviMag (France), no. 915, 1 Apr. 1986 p 34-35 Translated by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88008; NAS 1.15:88008) Avail: NTIS HC A02/MF A01 CSCL 51C

British Aerospace's space-going aircraft and economical launcher Hotol, so named for its horizontal take-off and landing ability, is described. The craft uses Rolls Royce's new Swallow engine, the principle behind which is still secret, which burns atmospheric oxygen until it leaves the atmosphere and then switches to liquid oxygen. This lightens the craft's fuel load tremendously, so that it can carry significant payloads and still take off and land like a normal airplane. A typical future mission for the craft is described. Author

N87-14318*# National Aeronautics and Space Administration, Washington, D.C.
DEEP STALL CHARACTERISTICS OF MU-300
Toshio Hanai Sep. 1986 14 p Transl. into ENGLISH from Japan Society for Aeronautical and Space Sciences Journal (Japan), v. 33, no. 377, Jun. 1985 p 322-325 Original language document was announced in IAA as A86-25203 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88502; NAS 1.15:88502; ISSN-0021-4663) Avail: NTIS HC A02/MF A01 CSCL 51C

The deep stall characteristics of the MU-300 Diamond aircraft are described. The MU-300 obtained type certification from the FAA in 1981, and from Canada, West Germany, and England in 1983. The aircraft has achieved a high angle of attack. The aerodynamic design, structural dimensions, and flight tests of the MU-300 are described. Author

N87-14319# Fairchild Industries, Inc., Farmingdale, N.Y.
ASSESSMENT OF DAMAGE TOLERANCE REQUIREMENTS AND ANALYSIS, TASK 1 REPORT. VOLUME 2: ANALYTICAL METHODS Final Technical Report, Sep. 1982 - Jun. 1984
A. Kuo, D. Yasgur, and M. Levy 31 Mar. 1986 133 p
(Contract F33615-82-C-3215)
(AD-A170327; AFWAL-TR-86-3003-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 13/13

The stress intensity factor and stress severity factor for typical airframe structures have been formulated using the compounded solution method. Two-dimensional and three-dimensional finite element analysis were performed to validate or obtain some of the factors. Two damage tolerance analysis methods have been developed based upon the stress intensity factor and stress severity factor. The first method is based on crack growth only. The second method is based on the combined crack growth and initiation. The strain energy density is proposed as the governing parameter of fatigue crack initiation. Author (GRA)

N87-14320# Air Force Flight Test Center, Edwards AFB, Calif.
C-130/C-141 CENTER VERTICAL RESTRAINT Final Report, 18 Mar. - 10 Apr. 1986

Miguel A. Lopez and Michael R. Wuest 7 Jul. 1986 41 p
(AD-A170438; AFFTC-TR-86-5) Avail: NTIS HC A03/MF A01 CSCL 15/5

This test program was conducted to evaluate airdrop of equipment from C-130 and C-141 aircraft with a center rail. The rail was designed to provide vertical and lateral restraint for A-22 cargo bags while in the cargo compartment. Nine tests each were conducted during this test program from both a C-130H and a C-141B. The C-130 flew at 130 knots and the C-141 flew at 150 knots indicated airspeed and both flew at 1000 feet AGL at test initiation. Container gross weights ranged from 625 to 2328 pounds. GRA

N87-14321# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
NONLINEAR DYNAMIC RESPONSE OF COMPOSITE ROTOR BLADES Final Report
John J. Engblom and Ozden O. Ochoa Jan. 1986 97 p
(Contract F49620-82-K-0032)
(AD-A173069; ME-4786-85-10; AFOSR-86-0934TR) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report summarizes research related to nonlinear dynamic response of composite rotor blades. Fundamental to the analysis is the development of a continuum formulation that can accurately account for the effects of interlaminar shear and interlaminar normal stress variation thru-the-thickness of a laminate. Technical highlights of the research efforts to date are presented for each of the proposed tasks--namely, nonlinear displacement formulation for composite media, incorporate damage mechanisms into dynamic response formulation, and correlation of formulated response model with experimental data. GRA

N87-14322# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF SHOCK AND VIBRATION ENVIRONMENTS FOR CARGO ON C9B TRANSPORT AIRCRAFT
T. J. Baca, J. W. Doggett, and C. A. Davidson 1986 15 p Presented at the 57th Shock and Vibration Symposium, New Orleans, La., 14 Oct. 1986
(Contract DE-AC04-76DP-00789)
(DE86-016101; SAND-86-1238C; CONF-8610140-2) Avail: NTIS HC A02/MF A01

The definition of shock and vibration environments on the floor of cargo aircraft is of prime interest to designers of hardware which must be transported on these planes and helicopters. The DOE/DOD Environmental Data Bank at Sandia National Laboratories maintains an extensive collection of environmental definitions for aircraft. This paper describes the process involved in acquiring and analyzing shock and vibration data on the cargo floor of a C9B turbojet aircraft for incorporation into the DOE/DOD Environmental Data Bank. The dual objectives of this paper are to show the procedure by which the environmental definition is created and to compare the results with existing definitions of shock and vibration environments on fixed wing aircraft. Special emphasis is placed on instrumentation considerations which help ensure data integrity. DOE

N87-14323# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
MEASUREMENTS OF LANDING GEAR LOADS OF A COMMUTER AIRLINER
Anders I. Gustavsson Jun. 1986 10 p Presented at the 15th ICAS Congress, London, England, 7-12 Sep. 1986 Previously announced in IAA as A86-49119 Sponsored by the Swedish Board for Technical Development
(FFA-TN-1986-37; ETN-86-98557) Avail: NTIS HC A02/MF A01

Strain gage measurements of forces acting on the nose gear and main gears of a SAAB SF-340 airliner are described. Forces in the longitudinal, transversal, and vertical directions are presented for takeoff, landing, taxiing, and towing. The investigation reveals unexpectedly high transversal loads at the main gears at touchdown. The nose gear is most severely strained when steering during taxiing run and when the aircraft is towed, connected to a tractor with a tow-bar. The results of the measurements formed the basis for an investigation with on-line data acquisition of landing gear loads on a commuter airliner in service. Such measurements reveal differences in load environment due to different pilots, runways, and weather conditions including seasonal variations. The data acquisition system and the data analysis methods are outlined. ESA

N87-14324# European Space Agency, Paris (France).
RESULTS OF ICING FLIGHTS IN WINTER 1983/1984: ICE ACCRETION THICKNESS IN CORRELATION WITH CLOUD PHYSICAL PARAMETERS, OBJECT AND CLOUD PARAMETERS
Hans-Eberhard Hoffmann, Roland Roth, and Johann Demmel Apr. 1986 41 p Original language document was announced as N86-15838
(ESA-TT-969; DFVLR-FB-85-39; ETN-87-98820) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany DM 16

Twenty-five icing flights on a DO28 research aircraft were carried out to determine the correlation between ice accretion thickness on standard cylinders and cloud physical parameters (liquid water content, temperature, particle phase and size), object parameters (cylinder diameter) and cloud parameters (cloud altitude, location coordinates, time, stratus or cumulus). The relationship between ice accretion thickness and water content is demonstrated with the ice accretion model of the Canadian National Research Council. Effects of the cloud particle size on ice accretion thickness could not be shown. The ice accretion thickness change due to liquid water content depends on cylinder diameter. Liquid water content, ice accretion thickness, and icing degree increase with altitude. Stratus or cumulus have no effects on the ice accretion thickness. ESA

N87-14325# European Space Agency, Paris (France).
CALCULATION OF ICE ACCRETION ON CYLINDRICAL RODS ACCORDING TO BAIN'S MODEL AND COMPARISON WITH EXPERIMENTAL RESULTS
Werner Fuchs, Klaus-Peter Schickel, Josef Kaluza, and Kurt Uwira Jun. 1986 83 p Original language document was announced as N86-18933
(ESA-TT-970; DFVLR-FB-85-46; ETN-87-98821) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 25.50

Bain's model for the calculation of ice accretion rates was compared with meteorological flight data. The Bain model for the determination of the ice accretion rate on cylindrical rods was extended to the calculation of the accretion shape and velocity in pure water clouds. The ice accretion was measured on an aircraft during flights in stratus clouds. By taking into account the energy balance estimate of Ludlam for the calculation of an upper bound on the spontaneously freezing supercooled liquid water content (LWC), good agreement between the calculated and measured ice accretion is obtained. The effect of higher LWC's on the ice accretion is not proportional, as theory shows. ESA

N87-14326# European Space Agency, Paris (France).
THE ICING RESEARCH AIRCRAFT Do28, D-IFMP OF DFVLR AND ITS MEASURING EQUIPMENT
Hans-Eberhard Hoffmann and Johann Demmel Apr. 1986 69 p Original language document was announced as N86-22064
(ESA-TT-972; DFVLR-Mitt-85-12; ETN-87-98822) Avail: NTIS HC A04/MF A01, original German version available from DFVLR, Cologne, West Germany DM 25.50

A Dornier Do28 D-IFMP, equipped as an icing research aircraft, is described. The accretion is measured on three metal cylinders and at the tip of one wing. The icing-relevant, cloud-physical parameters measured include air temperature, liquid water content, particle size (0.5 to 600 micron), particle concentration, particle phase (qualitative), visibility in and outside clouds, relative humidity, and absolute humidity. The measured data are recorded on two analog and one digital recorder. ESA

N87-14327# European Space Agency, Paris (France).
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF FLOW VECTOR MEASUREMENTS WITH ANGLE-OF-ATTACK AND SIDESLIP SENSORS ON DFVLR METEOROLOGICAL RESEARCH AIRCRAFT
Peter Muehlbauer Apr. 1986 158 p Original language document was announced as N86-21541
(ESA-TT-976; DFVLR-FB-85-50; ETN-87-98824) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 42.50

Calibration of the equipment of three powered sail planes and a jet plane with angle-of-attack and sideslip sensors for measuring the local flow vector, is described. The impact of angle-of-attack and sideslip and of other interfering parameters on the measured value was studied. A mathematical simulation of compressible flow at the tip of the probe is followed by experimental wind tunnel investigations, analysis, and application on inflight measurement. Criteria for flight-test use of the sensors are outlined. ESA

N87-14328# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany). Unternehmensbereich Transport- und Verkehrsflugzeuge
DEVELOPMENT OF A TECHNOLOGY FOR INCREASING PAYLOAD OF EXISTING AIRCRAFT (NEW 2) Final Report, Aug. 1985
Joachim Szodruch Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 85 p Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-007; ISSN-0170-1339; ETN-87-98879) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18

Simulation of viscous effects on airfoils was investigated. Modifications at the leading and trailing-edge of the wing are described. Corresponding design for the modified high lift system was carried out. The improvement in payload/range and DOC was evaluated. The development of existing aircraft was enhanced and the technology of variable camber for transport aircraft was supported. ESA

N87-14248# National Aerospace Lab., Tokyo (Japan).
NUMERICAL SIMULATION OF AN AIRCRAFT ICING
Daisuke Takahashi and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 1-6 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14260# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENTS OF NAVIER-STOKES CODE FOR HYPERSONIC SPACE-FLIGHT VEHICLES
Yukimitsu Yamamoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 103-111 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14275# National Aerospace Lab., Tokyo (Japan).
TRANSONIC WING AND AIRFOIL DESIGN USING INVERSE CODE WINDES
Susumu Takanashi *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 251-256 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14276# National Aerospace Lab., Tokyo (Japan).
APPLICATION OF COMPUTATIONAL AERODYNAMICS TO WING DESIGN UNDER FUSELAGE INTERFERENCE
Shogo Hirano and Norihiro Shinokawa *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 257-265 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14277# National Aerospace Lab., Tokyo (Japan).
THE ROLE OF COMPUTATIONAL FLUID DYNAMICS IN AERONAUTICAL ENGINEERING: THIRD REPORT
Toru Nohisa, Takashi Uchida, Tadamasa Jyonouchi, and Keisuke Sawada *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 267-276 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N87-14329 Singer-Link-Miles Ltd., Lancing (England).
A SIMULATED INSTRUMENT, SERIAL BUS SYSTEM Final Report
D. P. Allsop and L. G. Marini 30 Aug. 1986 106 p
(Contract MOD-A85a/393)
(LM/TR/654/2/2; ETN-86-98357) Avail: Issuing Activity

The feasibility of a bus system to interconnect simulated aircraft instruments was assessed. Instrument uses, serial bus types, and methods of implementation were studied. An approach which employs master-slave serial buses associated with each main group of software modules is presented. ESA

N87-14330*# Boeing Commercial Airplane Co., Seattle, Wash.
TEST AND EVALUATION OF A MULTIFUNCTION KEYBOARD AND A DEDICATED KEYBOARD FOR CONTROL OF A FLIGHT MANAGEMENT COMPUTER Final Report
J. M. Crane, G. P. Boucek, Jr., and W. D. Smith Nov. 1986 122 p
(Contract NAS1-17635)
(NASA-CR-178202; NAS 1.26:178202) Avail: NTIS HC A06/MF A01 CSCL 01D

A flight management computer (FMC) control display unit (CDU) test was conducted to compare two types of input devices: a fixed legend (dedicated) keyboard and a programmable legend (multifunction) keyboard. The task used for comparison was operation of the flight management computer for the Boeing 737-300. The same tasks were performed by twelve pilots on the FMC control display unit configured with a programmable legend keyboard and with the currently used B737-300 dedicated keyboard. Flight simulator work activity levels and input task complexity were varied during each pilot session. Half of the points tested were previously familiar with the B737-300 dedicated keyboard CDU and half had no prior experience with it. The data collected included simulator flight parameters, keystroke time and sequences, and pilot questionnaire responses. A timeline analysis was also used for evaluation of the two keyboard concepts. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N87-14331# Stuttgart Univ. (West Germany). Sonderforschungsbereich 85.
THERMODYNAMIC AND FLOW MECHANICAL PROBLEMS IN AIRCRAFT AND SPACECRAFT DRIVES Final Report, 1972-1985 [THERMODYNAMISCHE UND STROEMUNGSMECHANISCHE PROBLEME DER LUFT- UND RAUMFAHRTANTRIEBE]

Apr. 1986 459 p In GERMAN
(ETN-87-98751) Avail: NTIS HC A20/MF A01

Laser interferometry; reaction kinetics study in exhaust gases by mass spectrometry, Raman spectroscopy and electron beams; and concentration and relaxation times measurements are discussed. Flow and combustion processes, and numerical calculation methods are considered, including jet mixing flow, compressor blade profile and supercritical cascade design; flow computation in counter-rotating cascades, in chemically reacting flows, in three-dimensional cascade flow, and in multistage tubomachines. The effect of Reynolds number on turbomachines is investigated. Combined chemical propulsion systems are analyzed. For individual titles, see N87-14332 through N87-14347.

N87-14332# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
INTERFEROMETRY [INTERFEROMETRIE] c36
Guenther Schwarz *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 1-24 In GERMAN Previously announced as N83-34823 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

Interferometry was investigated as a contactless optical diagnostic method for the quantitative study of fully three-dimensional density fields in gas dynamics. The requirements imposed by the diagnostic method were fulfullid by improving measuring and evaluation facilities. The method proves successful on several supersonic flows about a body. With the help of information from other optical methods (e.g., Schlieren photography) accuracy of 1% can be obtained. The theoretical study resulted in the development of a method for the inversion of density fields from interferograms, and in several control and auxiliary programs. It is shown that the method can only be applied to unsteady three-dimensional fields if the amount of data is reduced. ESA

N87-14333# Stuttgart Univ. (West Germany).
ELEMENTARY-REACTION AND FLOW-MECHANICAL PROBLEMS IN AIRCRAFT AND SPACECRAFT DRIVES [ELEMENTARREAKTION UND STROEMUNGSMECHANISCHE PROBLEME DER LUFT- UND RAUMFAHRTANTRIEBE] c25
Hirst H. Grotheer and Ulrich Meier *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 25-56 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The elementary reactions in the oxidation of methanol and ethanol were investigated to optimize combustion processes with respect to efficiency and pollutant emission. The use of flow reactors with mass spectrometry and laser induced fluorescence made it possible to clarify the complex reaction mechanisms, and to quantitatively measure the reaction speed constants of the elementary reactions which constitute these mechanisms. The accompanying numerical simulation of the global system was especially important. In the reaction system of the methanol oxidation all essential elementary reactions, except reactions with hydrogen atoms, were analyzed. For ethanol oxidation, the important reactions C2H5OH+O and C2H5OH+OH were analyzed. ESA

N87-14334# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
MASS SPECTROMETRIC CONCENTRATION MEASUREMENTS IN SUPERSONIC FLOWS WITH CHEMICAL REACTIONS [MASSENSPEKTROMETRISCHE KONZENTRATIONSMESSUNGEN IN UEBERSCHALISTROEMUNGEN MIT CHEMISCHEN REAKTIONEN] c25
Arnold Frohn *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 57-76 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

A large shock tube installation was developed to investigate the evolution of concentrations in chemical reactions behind incident shock waves using mass spectrometry. The measurements show that the combination of shock tube and molecular beam allows a contactless sampling of the supersonic flow behind the incident shock waves. In the collimated molecular beam quadrupole mass spectrometric analyses of the gas composition were performed to determine the evolution of the reactions and the concentrations. The particle profiles measured in the molecular beam result in reaction kinetics data. Temperature and flow velocity in the expanded beam and behind the incident shock can be obtained. ESA

N87-14335# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
RELAXATION OF VIBRATIONAL DEGREES OF FREEDOM [RELAXATION VON SCHWINGUNGSFREIHEITSGRADEN] c72
Arnold Frohn *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 77-125 In GERMAN Previously announced as N83-34828 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

Shock wave investigations of the vibrational relaxation of polyatomic molecules and its effect on dissociation were performed. It is shown that the results of noise absorption measurements and measurements of the density structure of compression shocks in gases with several vibrational degrees of freedom only allow conclusions under extremely favorable conditions. Quantum mechanical calculations show that the relaxation time of vibrational degrees of freedom does not only depend on the gas temperature but also on the degree of deviation from equilibrium, in agreement with experimental results. Perturbations in the Boltzmann distribution of the vibrational degrees of freedom are observed in the relaxation zone behind strong shocks. The results of the vibrational relaxation time measurements in the neighborhood of equilibrium and the dissociation relaxation time measurements agree well with experimental results. ESA

N87-14336# Stuttgart Univ. (West Germany).
FLAME DIAGNOSIS USING COHERENT ANTI-STOKES RAMAN SCATTERING (CARS) [FLAMMENDIAGNOSE MIT CARS (COHERENT ANTISTOKES RAMAN SCATTERING)] c25
Winfried Stricker *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 127-152 In GERMAN Previously announced as N83-34829 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The CARS technique was developed for temperature measurements in flames. In narrow band CARS excitation the setup allows simultaneously temperature measurements with spontaneous Raman spectroscopy. In broadband CARS excitation, in order to reduce measuring times, only small modifications are required to allow the measurement of CARS and Raman spectra consecutively under identical conditions. Spatial resolutions better than 2mm are possible. Data evaluation programs were developed and tested. The comparison of narrow and broadband measurements show that the assumption of constant line widths leads to higher temperatures (up to 10%). The line model of Hall and Farrow shows good agreement with the Raman measurements. ESA

N87-14337# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
MULTIDIMENSIONAL SUPERSONIC FLOW WITH SUPPLY OF HEAT [MEHRDIMENSIONALE UEBERSCHALLSTROEMUNG MIT WAERMEZUFUHR] c02
Karl Foerster *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 153-162 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The configuration of a thin one dimensional flame layer along the surface of a body was considered for the analysis of supersonic flow with heat addition. In an inviscid, non-heat-conducting, two-dimensional flow, the heat layer is confined by two flow lines and the contour of flow about the body is also a flow line. Therefore, the flow line oriented finite difference method was used for the

flow field calculation. A method of characteristics was developed for the adiabatic case. ESA

N87-14338# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
COMBUSTION PROCESS OF HYDROGEN-AIR MIXTURES UNDER TECHNICAL CONDITIONS [VERBRENNUNGSABLAUF VON WASSERSTOFF-LUFT-GEMISCHEN UNTER TECHNISCHEN BEDINGUNGEN] **c25**
Johannes Algermissen and Peter Kasal *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 163-199 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

A test facility was built to investigate shock-induced supersonic combustion using a variable inclined shock diffusor for the development of jet engines. A high spatial flame resolution and a separation of mixing and reaction phenomena are obtained. A molecular beam probe equipped with a quadrupole mass spectrometer was developed for the determination of the local gas composition of the supersonic flame. The molecular beam technique was demonstrated by relative measurements of H2O and OH in an H2-air supersonic flame. For fast, local temperature measurements in weak light flames, a Raman spectroscopic measurement was developed. Flame temperature profiles were obtained with recording and evaluation times of 10 sec per point. A numerical calculation program based on the method of characteristics was developed for the description and analysis of stationary shocks and reacting supersonic flows. ESA

N87-14339# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
JET MIXING LOW [STRAHLMISCHUNG] **c34**
Bernhard Bauer and Welf Ebeling *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 201-242 In GERMAN Previously announced as N83-34831 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

A flow mechanical and thermodynamic analysis of the subsonic mixing of two air flows in a channel was performed. Measurements and comparative calculations of mixing channel flow fields were made. An evaluation method for time-dependent hot-wire signals was developed. A combined hot-wire/Pitot-tube probe allowed the measurements of pressure-pressure and pressure-velocity correlations, and thus the investigation of the influence of diffusive transport of turbulent kinetic energy due to pressure fluctuations on the mixing process, and the verification of the turbulence model. The effect of different flow conditions and channel contours on the mixing process was determined. A thermodynamically defined criterion for the comparison of measured and calculated flow distributions is given. ESA

N87-14340# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
DESIGN OF PROFILES FOR CASCADES [PROFILENTWURF FUER GITTER] **c02**
Lars Goettsching *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 243-267 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

Optimized cascade profiles for arbitrary applications were designed. The influence of Mach number, Reynolds number, and degree of turbulence were taken into account. The optimization aimed at maximum pressure increase, maximum pressure loss, low Reynolds number dependence, or large angle-of-attack range. Starting from the boundary layer form parameter distribution (by which transition point and separation point can be controled) the velocity distribution and the contour were calculated. The profile characteristics were tested off-design and were improved. Interferometric measurements were performed in the transonic cascade channel. ESA

N87-14341# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
COMPUTATION OF UNSTEADY, COMPRESSIBLE FLOW IN COUNTER-ROTATING PLANE BLADE CASCADES [BERECHNUNG DER IMSTATIONAEREN, KOMPRESSIBLEN STROEMUNG DURCH GEGENEINANDER BEWEGTE EBENE SCHAUFELGITTER]
Karl Foerster *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 269-282 In GERMAN Previously announced as N83-34833 (For primary document see N87-14331 06-07)
(Contract DFG-Az. Fo-119/3-1)
Avail: NTIS HC A20/MF A01

A method for flow computation in counter-rotating cascades was developed for two-dimensional inviscid flow. The blades can be arbitrarily thick, curved, and closely separated; the velocity domain ranges from low subsonic to far into the supersonic. The developed grid-free finite difference method is very flexible in the adaptation to any arbitrary configuration of the flow space. Its accuracy is demonstrated. The discretization procedure and the choice of initial values for the flow computation are explained. Calculation examples are presented. Studies to take friction into account were started. The averaged, unsteady, compressible Navier-Stokes equations, the turbulence model, and the solution procedure are presented. ESA

N87-14342# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
SUPERCRITICAL BLADE CASCADE DESIGN [ENTWURF SUPERKRITISCHER SCHAUFELGITTER] **c02**
Ekkehard Schmidt *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 283-326 In GERMAN Previously announced as N83-34834 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

An inverse blade cascade design method was developed with respect to computation accuracy, efficiency, and speed. The computation grid for the solution algorithm was refined. The program recognizes discontinuities in the velocity distribution. A potential correction was introduced. A boundary layer method was coupled to the design program. The program calculates the velocity distribution on the influx jet flow line. Algorithms and distortion functions were developed to allow the modification of the velocity distribution on the profile contour. The multigrid method is shown to be the most successful to accelerate the iterative solution process for the difference equation system. The inverse design method was tested and verified on examples. ESA

N87-14343# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
CALCULATION AND ANALYSIS OF CHEMICALLY REACTING SUPERSONIC FLOWS [BERECHNUNG UND ANALYSE CHEMISCH REAGIERENDER UEBERSCHALLSTROEMUNGEN] **c02**
Johannes Algermissen *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 327-336 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The time evolution of a reacting, two-dimensional, supersonic free jet was numerically investigated. The calculation starts with the flow take-off in the inlet of a wall channel, and continues until the free jet is fully built. The boundaries of the flow field are a fixed wall and the preceeding shock wave which introduce the ignition. The results for a reacting hydrogen-air free jet are presented; the evolution of the fields for the flow velocity, pressure, temperature, Mach number, and the mass of the combustion gas components were obtained. ESA

N87-14344# Stuttgart Univ. (West Germany). Inst. fuer Raumfahrtantriebe.
TRANSONIC AND SUPERSONIC COMPRESSORS [TRANSSCHALL- UND UEBERSCHALLVERDICHTER]
Hans-Heiner Fruehauf *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 337-367

In GERMAN Previously announced as N83-34836 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

Methods for flow computation in multistage turbocompressors operating in the transonic and supersonic domain were developed. Aerodynamic calculation methods are reviewed. Theory and numerical solution methods of the meridional, azimuthal, quasi-three-dimensional, and fully three-dimensional flow models are presented. Two and three-dimensional boundary layer integral methods are shown. ESA

N87-14345# Stuttgart Univ. (West Germany). Inst. fuer Raumfahrtantriebe.
COMBINED PROPULSION SYSTEMS, AEROTHERMODYNAMIC PROCESSES AND AN EVALUATION STUDY OF PROPULSION COMPONENTS AND SYSTEMS [KOMBINATIONSANTRIEBE - AEROTHERMODYNAMISCHE PROZESS- UND BEWERTUNGS-STUDIE VON ANTRIEBSKOMPONENTEN UND -SYSTEMEN]
Ulrich M. Schoettle *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 369-394 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

Chemical, combined jet engines for rockets were theoretically investigated for strongly differing flight conditions in order to develop a calculation method for the analysis of combined propulsion systems. The dependence of power characteristics and parameter sensitivities on the flight and propulsion conditions for LH2 are discussed. The numerical simulation uses the approximation of a one-dimensional flow and the assumption of chemical equilibrium in the propulsion combustion chamber. The aerothermodynamic analysis uses multidimensional calculations and reaction kinetics models. The flight and propulsion optimization was solved as a parameter optimization task. The results show promising application potential. ESA

N87-14346# Stuttgart Univ. (West Germany). Inst. fuer Luftfahrtantriebe.
EFFECT OF REYNOLDS NUMBER ON TURBOMACHINES [REYNOLDSZAHLEINFLUSS AUF STROEMUNGSMASCHINEN]
Willy Huck *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 395-414 In GERMAN Previously announced as N83-34838 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The flow characteristics, including the compressor pulsation limit, of multistage compressors were calculated, taking into account the effect of the Reynolds number. The duct-flow method proves to be suitable for fast calculations. With this method the characteristics are only calculated in the slits between the cascades. The multiple cut method provides a substantially better insight into the flow phenomena and gives better results, especially for compressors with low stage number; the calculation of the sidewall boundary and secondary flow complete the core flow calculation. Tests were conducted on a transonic axial compressor stage in order to improve and verify cascade correlations. A calculation method for the compressor pulsation limit via a stability analysis was developed. ESA

N87-14347# Stuttgart Univ. (West Germany). Inst. fuer Luftfahrtantriebe.
COMPUTATION OF FLOW THROUGH MULTISTAGE TURBOMACHINES TAKING INTO ACCOUNT FLOW LOSSES AND HEAT FLUXES [BERECHNUNG DER STROEMUNG DURCH MEHSTUFIGE TURBOMASCHINEN UNTER BERUECKSICHTIGUNG VON STROEMUNGSVERLUSTEN UND WAERMEFLUESSEN]
Wolfgang Braig *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 415-440 In GERMAN Previously announced as N83-34839 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

The transonic flow in turbomachines, as well as the friction and energy exchange phenomena in multistage turbomachines were calculated. The flow-function method was iteratively coupled with blade-to-blade calculations for the transonic flow calculation. For the flow-function method a system of equations was developed to determine the deviations of the flow from axisymmetry. A time-step method was programmed for the blade-to-blade calculations. The results of the coupled system show good agreement with measurements. In the modeling of friction effects, suitable velocity profiles were assumed in the boundary layer in order to determine shear stresses and dissipation in the sidewall domain. These profiles were calculated with a method for the calculation of noncollateral boundary layers, coupled with the flow-function method. This procedure permits determination of the stabilization of the sidewall boundary layer in multistage turbomachines. ESA

N87-14348*# Sverdrup Technology, Inc., Cleveland, Ohio.
EFFECTS OF DROPLET INTERACTIONS ON DROPLET TRANSPORT AT INTERMEDIATE REYNOLDS NUMBERS Final Contractor Report
Jian-Shun Shuen Dec. 1986 20 p Presented at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(Contract NAS3-24105)
(NASA-CR-179567; E-3293; NAS 1.26:179567; AIAA-87-0137)
Avail: NTIS HC A02/MF A01 CSCL 21B

Effects of droplet interactions on drag, evaporation, and combustion of a planar droplet array, oriented perpendicular to the approaching flow, are studied numerically. The three-dimensional Navier-Stokes equations, with variable thermophysical properties, are solved using finite-difference techniques. Parameters investigated include the droplet spacing, droplet Reynolds number, approaching stream oxygen concentration, and fuel type. Results are obtained for the Reynolds number range of 5 to 100, droplet spacing from 2 to 24 diameters, oxygen concentrations of 0.1 and 0.2, and methanol and n-butanol fuels. The calculations show that the gasification rates of interacting droplets decrease as the droplet spacings decrease. The reduction in gasification rates is significant only at small spacings and low Reynolds numbers. For the present array orientation, the effects of interactions on the gasification rates diminish rapidly for Reynolds numbers greater than 10 and spacings greater than 6 droplet diameters. The effects of adjacent droplets on drag are shown to be small. Author

N87-14349*# Garrett Turbine Engine Co., Phoenix, Ariz.
SCALED CENTRIFUGAL COMPRESSOR PROGRAM Final Report
G. Cargill and C. Linder 31 Oct. 1986 202 p
(Contracts NAS3-23277; DA Proj. 1L1-62209-AH-76)
(NASA-CR-174912; NAS 1.26:174912; USAAVSCOM-TR-85-C-13; Garrett-21-5464) Avail: NTIS HC A10/MF A01 CSCL 21E

Centrifugal compressors were provided to be used to evaluate the effects of direct scaling, and establishing the methodology for design adjustment when direct scaling is not mechanically feasible. These objectives were accomplished by the following approaches: (1) scaling an existing high-performance centrifugal compressor from 10-lb/sec to 2-1b/sec flow size; (2)making the necessary adjustments to the 2-lb/sec flow size compressor to make it mechanically acceptable; (3) directly scaling the final 2-lb/sec flow size compressor to 10-lb/sec flow size; and (4) fabricating the resulting 10-lb/sec and 2-1b/sec flow size compressors for testing in the NASA-Lewis Compressor Facilities. Author

N87-14350# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
CERAMIC BARRIER TURBINE BLADE DEMONSTRATION Final Report, Jan. 1984 - Mar. 1986
Daniel Shea May 1986 65 p
(Contracts DAAG46-84-C-0002; DA Proj. 1L1-62105-AH-84)
(AD-A169698; RI/RD86-150; MTL-TR-86-17) Avail: NTIS HC A04/MF A01 CSCL 11/2

The next generation of gas turbine engines will operate at temperatures that exclude using uncooled metal alloys for the turbine blades. Cooling of these blades is not the optimum approach because the large coolant flow requirements will adversely affect

engine efficiency. The Ceramic Barrier Turbine Blade program has successfully shown that a thermal barrier can be incorporated into the blade to shield the metal components from the hot turbine gases and greatly reduce coolant flow requirements. The principal component of this thermal barrier is a thin silicon nitride shell which envelopes a cooled metal core and retaining it with a cap at the blade tip. Loads on the shell are compressive, allowing the use of light, thin-walled sections. A novel two-layer insulating/cooling system is used to maintain the internal temperature 1000 F below the turbine operating temperature. The design features of the ceramic barrier turbine blade and the fabrication processes are described. Results of the successful spin test conducted to demonstrate concepts feasibility are presented. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N87-14351*# Systems Technology, Inc., Hawthorne, Calif.
ARCHIVE DATA BASE AND HANDLING SYSTEM FOR THE ORBITER FLYING QUALITIES EXPERIMENT PROGRAM Final Report
Thomas T. Myers, Richard DiMarco, Raymond E. Magdaleno, and Bimal L. Aponso Oct. 1986 86 p
(Contract NAS2-11900)
(NASA-CR-166622; H-1353; NAS 1.26:166622) Avail: NTIS HC A05/MF A01 CSCL 01C

The OFQ archives data base and handling system assembled as part of the Orbiter Flying Qualities (OFQ) research of the Orbiter Experiments Program (EOX) are described. The purpose of the OFQ archives is to preserve and document shuttle flight data relevant to vehicle dynamics, flight control, and flying qualities in a form that permits maximum use for qualified users. In their complete form, the OFQ archives contain descriptive text (general information about the flight, signal descriptions and units) as well as numerical time history data. Since the shuttle program is so complex, the official data base contains thousands of signals and very complex entries are required to obtain data. The OFQ archives are intended to provide flight phase oriented data subsets with relevant signals which are easily identified for flying qualities research. Author

N87-14352# European Space Agency, Paris (France).
A CONTRIBUTION TO DIGITAL COMPENSATION OF PERIODIC DISTURBANCES WITH FREQUENCIES IN BOUNDED INTERVALS
Rainer Froriep Sep. 1986 140 p Original language document was announced as N86-21553
(ESA-TT-979; DFVLR-FB-85-55; ETN-87-98886) Avail: NTIS HC A07/MF A01; original German version available from DFVLR, Cologne, West Germany DM 45.40

A general design method for the simplest possible compensator was developed in order to satisfy the requirement of stationary disturbance compensation within given tolerance limits for all helicopter rotor speeds within a given bounded interval. The approach to the suppression of rotor induced vibrations is to suspend the fuselage from the rotor by electrohydraulic actuators. Using a digital computer the most dominant harmonics of the disturbance can be actively compensated. For compensation at sampling instants, a structure of a digital controller is introduced and motivated, in which a minimal number of parameters is adapted to a varying rotor speed. The remaining parameters are to be held constant during operation independent of rotor speed. In the design, these parameters are systematically improved with a multi-disturbance model-approach and a design methodology with vector performance index. For disturbance suppression between sampling instants a design method for impulse forming filters is proposed. ESA

N87-14353 Texas Univ., Arlington.
THE HANDLING QUALITIES OF A LARGE JET TRANSPORT AIRCRAFT IN SEVERE WIND SHEAR AND TURBULENCE Ph.D. Thesis
Baxter Robert Mullins, Jr. 1985 216 p
Avail: Univ. Microfilms Order No. DA8611264

The effects of a variable wind field and heavy rain on the flying qualities of a large wide-body multiengine jet transport were examined by developing a six degree-of-freedom rigid-body simulation with a yaw damper control system. The simulation included nonlinear aerodynamics with aeroelastic, Mach, and load factor elements. The aircraft model was verified by comparison to previous simulations and flight tests. Linear analysis was performed by using small perturbation theory. The linearized aerodynamic coefficients were determined by small motion analysis of the full model about a trimmed flight condition. By running time histories of atmospheric wave and gust responses, the linear analysis was verified from small motions. Dissert. Abstr.

N87-14274# National Aerospace Lab., Tokyo (Japan).
INVESTIGATION OF A PREDICTION METHOD OF TRANSONIC FLUTTER CHARACTERISTICS USING UNSTEADY TRANSONIC AERODYNAMICS
Haruhiko Arakawa, Hideki Nomoto, Nobuo Toda, and Kouichi Hiraoka *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 243-249 In JAPNAESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N87-14354 Flughafen, Frankfurt am Main (West Germany).
THE SIMULATOR: THE PERFECT ILLUSION [DER SIMULATOR - DIE PERFEKTE ILLUSION]
Heinz Auth Mar. 1986 19 p In GERMAN
(Fachthemen-9; ETN-87-98862) Copyright. Avail: Issuing Activity

The development of flight simulator systems and pilot training is reviewed. Critical operations like emergency descent and roll can be practiced on the ground without danger. Plans for an entire pilot training on flight simulators are discussed. ESA

N87-14355* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DOUBLE WINDOW VIEWING CHAMBER ASSEMBLY Patent
Vernon W. Keller, inventor (to NASA), Robert B. Owen, inventor (to NASA), Bobby R. Elkins, inventor (to NASA), and William T. White, inventor (to NASA) Issued 21 Oct. 1986 6 p Filed 2 May 1985 Supersedes N85-28951 (23 - 18, p 3063)
(NASA-Case-MFS-28057-1; US-Patent-4,618,215; US-Patent-Appl-SN-729766; US-Patent-Class-350-319) Avail: US Patent and Trademark Office CSCL 14B

A viewing chamber which permits observation of a sample retained therein includes a pair of double window assemblies mounted in opposed openings in the walls thereof so that a light beam can directly enter and exit from the chamber. A flexible mounting arrangement for the outer windows of the window assemblies enables the windows to be brought into proper alignment. An electrical heating arrangement prevents fogging of the outer windows whereas desiccated air in the volume between the outer and inner windows prevents fogging of the latter.

Official Gazette of the U.S. Patent and Trademark Office

N87-14356# New Mexico Univ., Albuquerque. Engineering Research Inst.
ASPHALT-RUBBER SAMI (STRESS-ABSORBING MEMBRANE INTERLAYERS) FIELD EVALUATION Final Report, 29 Oct. 1984 - 30 Sep. 1985
R. G. McKeen, Raymond D. Pavlovich, and Vincent Cassino Apr. 1986 161 p
(Contract F29601-84-C-0080)
(AD-A169700; NMERI-WA5-7(5.06); AFESC/ESL-TR-86-02) Avail: NTIS HC A08/MF A01 CSCL 13/3

The investigation of asphalt-rubber mixtures for use as stress-absorbing membrane interlayers (SAMIs) for airfield pavements is described. The project was initiated in 1977 as a state-of-the-art review, which study concluded that use of SAMIs was promising for improving the performance of asphalt-concrete overlays on airfield pavements. A following study addressed material characterization and development of a proposed construction specification. This report covers follow-on monitoring of the performance of an experimental pavement project at Kirtland AFB, Apron A; construction and performance monitoring of two trial sections located at Williams AFB and Coolidge Field in Arizona; and the design and construction of a field experiment at Peterson AFB, Colorado. Based on the results obtained to date, the performance observed cannot be related in a meaningful way to the material characteristics. This results from the small time elapsed since construction of the pavements under observation. Based on experience, a revised proposed construction specification is included in the current report. Continued performance monitoring is recommended in order to obtain the benefit from the investment made initially. GRA

N87-14357# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF MECHANISTIC FLEXIBLE PAVEMENT DESIGN CONCEPTS FOR THE HEAVYWEIGHT F-15 AIRCRAFT Ph.D. Thesis
Henry F. Kelly, IV 1986 232 p
(AD-A170902; AFIT/CI/NR-86-88D) Avail: NTIS HC A11/MF A01 CSCL 01/5

A new configuration of the F-15 aircraft is being used by the U.S. Air Force. This heavyweight F-15 has a 30-kip/355-psi wheel loading. The F-15 will become the controlling aircraft for design of airfield Light-Load Pavements. A review is presented of the concepts and development of the present Department of Defense (DOD) method for flexible airfield pavement design. The structural model used in this study to calculate pavement structural responses (stresses, strains, deflections) is the finite element program ILLI-PAVE. This program considers the pavement as an axisymmetric solid, and accommodates stress-dependent materials and soils, and stress corrections according to Mohr-Coulomb failure criteria. Multiple regression analyses are performed on the ILLI-PAVE data base to develop prediction equations (algorithms) for pavement structural responses of interest. These equations have high statistical precision when compared against the ILLI-PAVE data base. Therefore, they may be used in lieu of running ILLI-PAVE, which generally requires a main-frame computer. Pavement test section data obtained from the literature are analyzed using ILLI-PAVE. Transfer functions are derived relating calculated pavement responses to coverages till failure. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N87-14358*# National Aeronautics and Space Administration, Washington, D.C.
EXTRATERRESTRIAL RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY
Sep. 1986 59 p Transl. into ENGLISH of "Extraterrestrische Forschung in der Bundesrepublik Deutschland" West Germany, DFVLR, Dept. RF-TN, 5 May 1986 p 1-49 Transl. by Scitran, Inc., Santa Barbara, Calif. Original document prepared by German Research Society for Air and Space Travel
(Contract NASw-4004)
(NASA-TM-88010; NAS 1.15:88010) Avail: NTIS HC A04/MF A01 CSCL 84A

This German program for basic extraterrestrial research is an essential, successful, and worldwide recognized part of the space program and has the same attributes for basic research in the Federal Republic of Germany. It covers all major scientific disciplines. Author

N87-14359# MATRA Espace, Paris-Velizy (France).
RENDEZVOUS AND DOCKING (RVD) GUIDANCE SIMULATION PROGRAM, RIDER 2 Final Report
C. Pauvert and R. Worswick Paris, France ESA Jan. 1986 212 p Prepared in cooperation with Logica Ltd., London, England
(Contract ESA-5347/83-NL-BI(SC))
(Matra-EPT/DT/VT068/012; ESA-CR(P)-2238; ETN-86-98116) Avail: NTIS HC A10/MF A01

Propellant sloshing and structural flexibility were added to the RVD Simulation Program (now called RVD Guidance Simulator). The performance of the modified program for realistic mission configurations and docking conditions was evaluated. The basic structure of the RVD Guidance Simulator (RVD GS) is kept, but to save computing time, a basic two body (chaser+target) version of the program was developed, rather than a three body version including a dummy Earth, previously used to overcome numerical problems. Simulations provide sets of typical docking conditions in terms of spacecraft relative position, velocity, attitude, and attitude rate for various geometric, dynamic, and control configurations. Worst case parameters are derived from the simulations as typical initial conditions to the Docking Simulation Program. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N87-14360# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NONSINGULAR PARAMETRIC EXPRESSIONS FOR ORBIT PROPAGATION BY THEORETICAL ESTIMATION OF PARAMETERS M.S. Thesis [EXPRESSOES PARAMETRIZADAS NAO SINGULARES PARA PROPAGACAO DE ORBITAS VITA TEORIA DE ESTIMACAO DE PARAMETROS]
Carlos deOliveira Lino Nov. 1986 103 p In PORTUGUESE; ENGLISH summary
(INPE-4024-TDL/241) Avail: NTIS HC A06/MF A01

A modification is proposed in the stochastic procedure developed for the propagation of satellite orbits via adjusted parametric expressions for the time variation of the Keplerian elements of a satellite. The modification proposed in the choice of variables of the orbit equations aims to eliminate singularities and generalize the procedure's application. The adjustment of coefficients of the modelled expressions is done by sequential processing, with use of the extended Kalman filter. The new set of expressions allows propagation of all types of orbit, including the critical cases of equatorial and circular orbits which present singularities in the classical Keplerian elements. Author

N87-14361# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STATISTICAL MODELS FOR PREDICTING THE CHANGE IN MEAN MOTION OF A SATELLITE OVER TIME INCLUDING THE EFFECTS OF SOLAR FLUX M.S. Thesis
James M. Burns Dec. 1985 72 p
(AD-A170591; AFIT/GSO/ENS/85D-5) Avail: NTIS HC A04/MF A01 CSCL 22/3

This investigation derived a simple model to determine the change in mean motion over time when the actual values are

unknown. A method was developed to include effects of solar flux by calculating an average value of n over 30 days. The model requires a knowledge of the mean motion for about 30 days before the time of interest to calculate this average. The analysis was done using BMDP on a CDC Cyber 6000 computer using element set data from actual satellites. This model does not attempt absolute accuracy, but is intended to be a method to quickly approximate a new mean motion when real values are not available. A limitation of this model is the amount of historical data and analyst judgement which are required. GRA

N87-14362# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
FROZEN ORBITS-NEAR CONSTANT OR BENEFICIALLY VARYING ORBITAL PARAMETERS Ph.D. Thesis
Richard C. Murrow 15 May 1986 134 p
(AD-A170675; AFIT/CI/NR-86-85D) Avail: NTIS HC A07/MF A01 CSCL 03/3

If a satellite were experiencing pure Keplerian motion its orbital elements would remain constant. In actuality, each orbiting body is acted upon by various perturbing forces. Consequently, the orbital elements are continuously subject to change. The forces generating deviation from basic two-body motion consist of, but are not limited to: the Earth's oblateness, atmospheric drag, lunar-solar gravitation, and solar radiation pressure. Whereas the magnitudes of such perturbing forces are small and varying compared to the gravity effects of the Earth, they are persistent and cause the resulting orbit to depart from its Keplerian counterpart. The variation of the five orbital elements which delineate the size, shape, and orientation of an elliptic orbit, can be determined with reasonable accuracy from existing theory. An understanding of disturbed orbital behavior permits possible control of the elements and exploitation of the inevitable physical effects of perturbations. This thesis provides physical understanding, theories, and mathematical formulations for different types of frozen orbits. Included in the frozen orbit concept are minimum altitude variation arcs, various categories of low Earth orbits such as Sun synchronous, and geosynchronous orbits. This study serves as a readily accessible and useful source of information on Earth orbiting satellites which have near constant or beneficially varying orbital parameters. GRA

N87-14363# Fundacio Empresa i Ciencia, Barcelona (Spain).
STATIONKEEPING OF LIBRATION POINT ORBITS, EXECUTIVE SUMMARY Final Report
G. Gomez, J. Llibre, R. Martinez, and C. Simo Paris, France ESA Nov. 1985 130 p
(Contract ESOC-5648/83-D-JS(SC))
(ESA-CR(P)-2272; ETN-86-98139) Avail: NTIS HC A07/MF A01

Stationkeeping for near halo orbits in the Earth-Moon-Sun system is studied. The full solar system is considered as a perturbation of the restricted three body problem. The families of halo orbits and the motion near them is studied. The general equations of motion are integrated to get the final nominal quasi-periodic orbit. The on/off stationkeeping is based on geometrical considerations using a dynamical systems approach. Software to perform analytical and numerical computations and to do simulations of the real behavior was produced. It is proved that the proposed method is very cheap in terms of fuel and it requires no computing time when the nominal orbit and projection factors are available. The feasibility of radiation pressure and low thrust stationkeeping is shown. ESA

N87-14364# SATCOM International, Paris (France).
ANALYSIS OF RENDEZVOUS AND DOCKING IN GEOSTATIONARY EARTH ORBIT. RIDER TO COMPARISON OF FUTURE COMMUNICATIONS SPACE SEGMENT CONCEPTS Final Report
C. Cougnet, J. M. Aubertin, Ph. LeBouar, B. Govin, A. Ayoun, and M. Caldichoury Toulouse, France Matra Espace Sep. 1982 164 p
(Contract ESA-4818/81-NL-MD)
(DM51-C/PL/FL/0099.82; ESA-CR(P)-2011-Vol-2; ETN-87-98644) Avail: NTIS HC A08/MF A01

Geostationary rendezvous homing, final approach, and docking phases were analyzed. The target is assumed to be a linear telecommunication platform composed of a service module and several payload modules; when operating, the platform must not be disturbed by the rendezvous and docking (RVD) operations. A period of time compatible with the orientation of the solar arrays is allocated each day for the final approach and docking phase. The homing phase and final approach are analyzed with simulations which propose a nominal strategy to meet the constraints and requirements, and to reuse as much as possible hardware already implemented on board. The analysis of docking phase is performed in terms of performance and requirements, and results in the definition of docking mechanism concepts. Block diagram of the RVD is compared to the reference scenario; the applicability of the scenario to ESAS platform and specific RVD hardware are discussed. ESA

N87-14365# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
ORBIT CALCULATION FOR ARTIFICIAL EARTH SATELLITES
J. Straka 1986 119 p In GERMAN; ENGLISH summary
(GKSS-86/E/21; ETN-87-98876) Avail: NTIS HC A06/MF A01

A NOAA program package for the determination of the position of an artificial Earth satellite was investigated. This program serves as a standard tool for research in the field of remote sensing. It is explained how perturbations of the Kepler orbit can be described with celestial mechanics methods. The method of Zeipel for the determination of perturbations of several orders of magnitude and the application of this method for the development of the theory of Brouwer for the motion of Earth satellites are presented. Results of the program for the orbit of the NOAA-7 satellite are discussed. ESA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N87-14366*# Harris Corp., Melbourne, Fla.
DEVELOPMENT OF THE 15 METER DIAMETER HOOP COLUMN ANTENNA Final Report
Washington NASA Dec. 1986 161 p
(Contract NAS1-15763)
(NASA-CR-4038; NAS 1.26:4038) Avail: NTIS HC A08/MF A01 CSCL 22B

The building of a deployable 15-meter engineering model of the 100 meter antenna based on the point-design of an earlier task of this contract, complete with an RF-capable surface is described. The 15 meter diameter was selected so that the model could be tested in existing manufacturing, near-field RF, thermal vacuum, and structural dynamics facilities. The antenna was designed with four offset paraboloidal reflector surfaces with a focal length of 366.85 in and a primary surface accuracy goal of .069 in rms. Surface adjustment capability was provided by

manually resetting the length of 96 surface control cords which emanated from the lower column extremity. A detailed description of the 15-meter Hoop/Column Antenna, major subassemblies, and a history of its fabrication, assembly, deployment testing, and verification measurements are given. The deviation for one aperture surface (except the outboard extremity) was measured after adjustments in follow-on tests at the Martin Marietta Near-field Facility to be .061 in; thus the primary surface goal was achieved. Author

N87-14367# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany). Inst. fuer Chem. Antriebe und Verfahrenstechnik.

WINGED SPACE TRANSPORTERS: THE PROBLEM OF THE NUMBER OF STAGES [GEFLUEGELTE RAUMTRANSPORTER: DAS PROBLEM DER STUFENZAHL]

R. E. Lo and D. M. Wolf 1986 24 p In GERMAN Presented at the Symposium Gefluegeite Raumfahrzeuge 2, Hanover, West Germany, 6 Jun. 1986 ; sponsored by Hermann-Oberth-Gesellschaft e.V.

(ETN-87-98863) Avail: NTIS HC A02/MF A01

The number of stages and the recoverability of space transportation systems was studied. Comparison of the payload of present carriers with studies of partly reusable systems shows that modern materials and structures can lead to significantly better capacity; the Shuttle technology only allows one third of the payloads possible in systems of that size. Models of reusable winged rockets show similar correlations for the payload as a function of the absolute size, as in the case of existing carriers. The favorable results obtained for purely rocket-driven two-stage systems are by far superior to those of single-stage systems with similar technology. Air breathing (ramjet) engines are useful but not necessary. Only two-stage, winged, fully reusable space transportation systems are technically feasible in the foreseeable future. The cost analyses have large error bars. The potentially lower operation costs of single-stage systems cannot outweigh the higher flexibility of two-stage systems. ESA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N87-14368*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on NASA Scientific and Technological Program Reviews.

POST-CHALLENGER ASSESSMENT OF SPACE SHUTTLE FLIGHT RATES AND UTILIZATION

Oct. 1986 52 p

(Contract NASw-3511)

(NASA-CR-180105; NAS 1.26:180105) Avail: National Research Council, 2101 Constitution Ave. N.W., Washington, D.C. 20418 HC free; NTIS HC A04/MF A01

Possible space shuttle flight rates and their implications in respect to payloads and the need for expendable launch vehicles are assessed. B.G.

N87-14369# Committee on Commerce, Science, and Transportation (U. S. Senate).

SPACE SHUTTLE ACCIDENT

Washington GPO 1986 219 p Hearings before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 99th Congress, 2d Session, 18 Feb., 10, 17 Jun. 1986

(S-Hrg-99-967; GPO-62-885) Avail: Subcommittee on Science, Technology and Space

Four subjects were discussed: events which lead up to the launch and destruction of the Challenger; the possibility of separation of the shuttle from the solid booster rockets in an emergency; the future of the shuttle program; and the direction of the future of the U. S. Space Program. Testimony was also heard from the Rogers Commission. B.G.

N87-14370# Air Force Academy, Colo.

MMU (MANNED MANEUVERING UNIT) TASK SIMULATOR Final Report, Jun. 1985 - Jan. 1986

Salvatore Alfano 15 Jan. 1986 80 p

(AD-A169552; USAFA-TR-86-2) Avail: NTIS HC A05/MF A01 CSCL 22/1

Described are simplified mathematical models of the Manned Maneuvering Unit (MMU) used in the USAFA Proximity Operations Simulator for the VAX 11/780 and the Evans and Sutherland PS 300 computers. This simulator serves as a learning aid for cadets studying orbital dynamics and MMU mission planning and as a research platform for the Department of Astronautics. The Manned Maneuvering Unit (MMU) Proximity Operations Simulator is a nine degrees-of-freedom trajectory integrator (six degrees of freedom for the MMU and three degrees of freedom for the target) which generates digital and graphical data to describe relative motion of the MMU and a free-flying target. This motion is obtained by applying the Clohessy-Wiltshire equations for terminal rendezvous/docking with the Earth modeled as a uniform sphere and aerodynamic forces ignored. MMU position relative to target is computed by a first-order Euler integrator which uses quaternions to define the rotational state. The target is modeled as a Space Transportation System (STS) Orbiter. The MMU is treated as a rigid body whose mass properties (gross wt., moments and products of inertia, and center of gravity location) are set within the porgram and remain constant. GRA

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N87-14371# MATRA Espace, Toulouse (France).

PACKET TELEMETRY Final Report

A. Blanc, P. Isambert, K. Held, and J. Tusch Paris, France ESA 15 Nov. 1985 137 p Prepared in cooperation with Dornier-Werke GmbH, Friedrichshafen, West Germany

(Contract ESTEC-5412/83-NL-HP(SC))

(Matra-RF/176/0898-Issue-1-Rev.; ESA-CR(P)-2204; ETN-86-98089) Avail: NTIS HC A07/MF A01

The CCSDS guidelines for onboard data handling systems (OBDH) using packet telemetry were analyzed, and a system which complies with these and with OBDH developments at ESTEC was defined. Hardware and software components, and a protocol were developed. Evaluation tests prove the correctness of the system design and of the implementation of the packet telemetry guidelines. Projects which implement, or are considering the packet telemetry standard include EURECA, Columbus, and SOHO. ESA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N87-14372 Y-ARD Ltd., Glasgow (Scotland).

THE DEDUCTION OF BEARING FORCES IN ROTATING

MACHINERY
R. Kinns 19 Jun. 1986 16 p
(BR99658; ETN-87-98642) Avail: Issuing Activity

A technique for the deduction of bearing forces in a complete marine installation is described. Shaker trials with a machine running determine response at bearing caps due to application of a known force at several positions on the machine and its supporting structure. The results are interpreted reciprocally to allow the bearing forces to be deduced from measurements of vibration due to the rotating shaft, using multiple regression to minimize the effects of experimental errors. ESA

N87-14373* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FOLDABLE SELF-ERECTING JOINT Patent
Timothy E. Pelischek, inventor (to NASA) Issued 7 Oct. 1986 8 p Filed 9 Mar. 1984 Supersedes N84-32424 (22 - 22, p 3542) (NASA-Case-MSC-20635-1; US-Patent-4,615,637; US-Patent-Appl-SN-588039; US-Patent-Class-403-85; US-Patent-Class-403-102; US-Patent-Class-403-119; US-Patent-Class-403-146; US-Patent-Class-403-163; US-Patent-Class-16-294; US-Patent-Class-16-370) Avail: US Patent and Trademark Office CSCL 22B

The invention relates to a foldable self erecting joint which may be used to deploy the tetratruss frame of the proposed shuttle launched triangular space station. The frame must be folded into the payload bay of the space shuttle orbiter. To deploy the frame the tubes are automatically unfolded and once in position should remain safely. A pair of hinged, tubular members in which the hinging is located at corresponding portions of the members are used. The opposite edge portions are connected by spring-based toggle links which in the unfolded position of the members are nested against one of the members in substantial alignment and over-center for securely locking the joint in the unfolded position.
Official Gazette of the U.S. Patent and Trademark Office

N87-14374*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE SMRM DEGRADATION STUDY WORKSHOP
1985 351 p Workshop held in Greenbelt, Md., 9-10 May 1985 (NASA-TM-89274; Rept-408-SMRM-79-0001; NAS 1.15:89274) Avail: NTIS HC A16/MF A01 CSCL 22B

The proceedings of the Solar Maximum Repair Mission Degradation Study Workshop, held at the Goddard Space Flight Center in Greenbelt, Maryland on May 9 to 10, 1985 are contained. The results of tests and studies of the returned Solar Maximum Mission hardware and materials are reported. Specifically, the workshop was concerned with the effects of four years' exposure to a low-Earth orbit environment. To provide a background for the reported findings, the summary includes a short description of the Solar Maximum Mission and the Solar Maximum Repair Mission. For individual titles, see N87-14375 through N87-14393.

N87-14375*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REPORT ON SMRM C/P MAIN ELECTRONICS BOX COMPONENT AND MATERIALS DEGRADATION EVALUATIONS
Robert E. Davis *In its* Proceedings of the SMRM Degradation Study Workshop 1985 p 33-40 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The history of the Main Electronics Box (MEB), a description of the the assembly, and handling conditions following the Solar Maximum Repair Mission are contained. B.G.

N87-14376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MAIN ELECTRONICS BOX (MEB) OF THE HAO CORONAGRAPH/POLARIMETER
In its Proceedings of the SMRM Degradation Study Workshop 1985 p 41-86 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The Solar Maximum Mission (SMM) was launched in February, 1980 with a complex of instruments designed to study the active Sun. The HAO instrument (C/p) operated satisfactorily until July when a series of partial failures began. Analysis and resolution of problems up to the terminal failure on September 23, 1980 are described. The Main Electronic Box (MEB) was replaced in orbit in April, 1984, restoring the observational capability of the c/p instrument. The process of trouble-shooting and restoration of the failed MEB is described. Conclusions are presented regarding the cause of the failures encountered. Author

N87-14377*# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
RADIATION EFFECTS ON SELECTED ELECTRONICS PARTS FROM THE SOLAR MAX SATELLITE
R. H. Maurer and O. M. Uy *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 87-124 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The Solar Maximum Satellite was launched on February 14, 1980. Problems with the Main Electronics Box (MEB) were experienced in the period July 10 to September 30, 1980. Failure occurred in the October to November time frame. Replacement of the Main Electronic Box (MEB) was performed in April 1984. The failed original MEB was returned to Earth and offered an opportunity to study some electronic parts which had spent 50 months in the natural radiation environment of a low Earth orbit (LEO) spacecraft. Spare parts were annealed at ambient temperatures on the ground. Dose rate effects between the flight and laboratory environments were compared. B.G.

N87-14378*# Teledyne Systems Co., Northridge, Calif.
FAILURE ANALYSIS AND PERFORMANCE EVALUATION OF NASA INERTIAL REFERENCE UNIT (DRIRU 2) AFTER 50 MONTHS OF ORBITAL OPERATION
K. N. Green, J. W. Ritter, D. Skinner, and R. L. VanAlstine *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 125-146 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The first production DRIRU 2 (NASA standard high performance inertial reference unit) system was launched as a subsystem of the Modular Attitude Control System for the Solar Maximum Mission (SMM) spacecraft in February 1980. This hardware was retrieved during the repair of the SMM during Shuttle Flight 41-C in April 1984 and returned to Teledyne Systems Company (manufacturer) for investigation and performance measurements as directed by Goddard Space Flight Center. A failure of one of the three gyro channels occurred approximately 6.5 months after launch. The built in redundancy functioned properly, the DRIRU 2 continued to provide the required attitude control function without performance degradation. Subsequent failure of other attitude control subsystems made the SMM a candidate for the first demonstration of the shuttle in-orbit repair capabilty. The in-orbit DRIRU 2 II failure scenario and the results of the analyses/tests conducted after retrieval are discussed. Comparison of this data with similar data prior to launch demonstates the excellent stability of performance parameters achieveable with DRIRU 2. Author

N87-14379*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF DRIRU BEARINGS AND LUBRICANT FROM SOLAR MAX REPAIR MISSION
Joanne M. Uber *In its* Proceedings of the SMRM Dogradation Study Workshop 1985 p 147-169 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The Solar Maximum Repair Mission (SMRM) by the shuttle astronauts in April 1984, returned to Earth the Delta Redundant Inertial Reference Unit 2 (DRIRU 2) from the Solar Maximum

satellite. The DRIRU 2 included three gyroscopes. The gyroscope, S/N 094, in position 2 was disassembled by Teledyne Systems personnel of Northridge, California, and the bearings were returned to Goddard Space Flight Center for examination. The Solar Max Satellite was in orbit for 4 years with the bearings running continuously at 6000 rpm. The ball bearings, had sufficient remaining lubrication and had runs successfully for over the last 4 years. As a result of these findings, the bearings should have lasted their predicted life of 5 years with no problems. Author

N87-14380*# Schonstedt Instrument Co., Reston, Va.
POSTFLIGHT EVALUATION OF THE SOLAR MAXIMUM SPACECRAFT MAGNETOMETERS
Warren D. Dunham *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 170-178 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The Solar Maximum Mission spacecraft was launched February 14, 1980 from Cape Kennedy. Attached to one side of the spacecraft was the Modular Attitude Control System (MACS). Two Schonstedt magnetometers were located within the MACS module. Although primarily used as a backup attitude determination system during the Solar Maximum Repair Mission, the magnetometers were instrumental in stabilizing the spacecraft. In October of 1984 the Solar Maximum magnetometers were returned to Schonstedt Instrument Company for postflight analysis, where they were subjected to the same electrical performance tests performed prior to use. In both instances the magnetometer performance was exceptional. Postflight test data nearly duplicated preflight test data. Author

N87-14381*# Sperry Flight Systems, Phoenix, Ariz.
SOLAR MAXIMUM MISSION POST FLIGHT PERFORMANCE ANALYSES OF STANDARD REACTION WHEELS S/N's 102, 103, 104 AND 105
In NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 179-206 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

On 24 January 1985, the four Solar Maximum Mission Reaction Wheels, S/N 102 through 105 were returned to Sperry for postflight analysis. The analysis consisted of visual examination; preliminary electrical checks; performance testing at ambient, hot, and cold temperature environments; and internal pressure measurements. Based on the performance test results and past utilization in space, one reaction wheel was selected for teardown to study lubricant distribution, bearing and reservoir lube loss, bearing raceway condition, and visual examination of conformal coating, soldering, and other internal features. B.G.

N87-14382*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POST FLIGHT ANALYSIS OF NASA STANDARD STAR TRACKERS RECOVERED FROM THE SOLAR MAXIMUM MISSION
P. Newman *In its* Proceedings of the SMRM Degradation Study Workshop 1985 p 207-210 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The flight hardware returned after the Solar Maximum Mission Repair Mission was analyzed to determine the effects of 4 years in space. The NASA Standard Star Tracker would be a good candidate for such analysis because it is moderately complex and had a very elaborate calibration during the acceptance procedure. However, the recovery process extensively damaged the cathode of the image dissector detector making proper operation of the tracker and a comparison with preflight characteristics impossible. Otherwise, the tracker functioned nominally during testing. Author

N87-14383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF EXAMINATION OF MATERIALS FROM THE SOLAR MAXIMUM RECOVERY MISSION
John J. Park *In its* Proceedings of the SMRM Degradation Study Workshop 1985 p 211-226 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Four years and two months in space at 310 nautical miles orbit has produced different effects on Kapton, silver/Teflon, and on aluminum. Kapton, a polyimide, lost up to 31% in thickness, though other locations showed much less loss. The degradation of silver/Teflon was drastic but very localized, due perhaps to the formation of silver oxide, Ag2O, through cracks in the protective Inconel layer which exposed the silver to the oxygen atom environment. Penetrations of the thin aluminum sheet in the form of thermal louvers and also of the thermal blanket material due to unknown particles were unexpected, making the debris a potentially serious problem because of the threat of damage to components. Author

N87-14384*# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
STUDIES OF EROSION OF SOLAR MAX SAMPLES OF KAPTON AND TEFLON
R. M. Fristrom, R. C. Benson, C. B. Bargeron, T. E. Phillips, C. E. Vest, C. H. Hoshall, F. G. Satkiewicz, and O. M. Uy *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 227-242 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Several samples of Kapton and Teflon which was exposed to solar radiation were examined. The samples represent material behavior in near Earth space. Clues to the identity of erosive processes and the responsible species were searched for. Interest centered around oxygen atoms which are ubiquitous at these altitudes and are known to erode some metal surfaces. Three diagnostic methods were employed: optical microscopy, scanning electron microscopy, and fourier transform infrared spectroscopy. Two types of simulation were used: a flow containing low energy oxygen atoms and bombardment with 3000 volt Ar ions. Results and conclusions are presented. E.R.

N87-14385*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF MICROMETEORITE MATERIAL CAPTURED BY THE SOLAR MAX SATELLITE
L. S. Schramm (Lockheed Engineering and Management Services Co., Inc., Houston, Tex.), D. S. McKay, H. A. Zook, and G. A. Robinson *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 243-244 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

A Solar Maximum satellite was retrieved and repaired after being subjected for four years and 55 days to impacts by micrometeorites and Earth-orbiting space debris. The chemical variety and physical condition of particles associated with two particular impact structures in the insulation blanket of the main electronics box are studied. A scanning electron microscope equipped with an energy dispersive X ray analyzer was used to determine morphology and chemistry of impacted areas and associated particles. Some details are discussed. E.R.

N87-14386*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EXAMINATION OF RETURNED SOLAR-MAX SURFACES FOR IMPACTING ORBITAL DEBRIS AND METEOROIDS
D. J. Kessler, H. A. Zook, A. E. Potter, D. S. McKay, U. S. Clanton (Department of Energy, Las Vegas, Nev.), J. L. Warren (Northrop Services, Inc., Houston, Tex.), L. A. Watts, R. A. Schultz (Purdue Univ., West Lafayette, Ind.), L. S. Schramm (Lockheed Engineering and Management Services Co., Inc., Houston, Tex.), S. J. Wentworth et al *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 245-246 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

The thermal insulation of the Solar Maximum Mission launched on 14 February 1980 which consisted of 17 layers of

alumized Kapton offers an excellent opportunity to obtain chemistry of impacting particles. To date, approximately 0.7 sq. met. of the insulation and 0.05 sq. met. of the aluminum louvers have been mapped by optical microscope for crater diameters larger than 40 microns. Atomic oxygen has eroded up to 20 microns of the exposed Kapton surfaces removing the older and smaller craters. The crater size distribution found on 3 different Kapton surfaces is shown. About 250 chemical spectra were recorded of particles observed in or around impact pits or in the debris pattern found on the second layer beneath impact holes in the outer layer. The debris populations are listed and discussed. E.R.

N87-14387*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A PRELIMINARY REPORT ON THE STUDY OF THE IMPACT SITES AND PARTICLES OF THE SOLAR MAXIMUM SATELLITE THERMAL BLANKET
Herbert A. Zook *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 247-264 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

A preliminary study of the work on examination of the impact pits in, or penetrations through, the thermal blankets of the Solar Maximum Satellite is presented. The three largest pieces of the thermal blanket were optically scanned with a total surface area of about one half square meter. Over 1500 impact sites of all sizes, including 432 impacts larger than 40 microns in diameter, have been documented. Craters larger in diameter than about 100 microns found on the 75 micron thick Kapton first sheet of the main electronics box blanket are actually holes and constitute perforations through the blanket. A summary of the impact pit population that were found is given. The chemical study of these craters is only in the initial stages, with only about 250 chemical spectra of particles observed in or around impact pits or in the debris pattern being recorded. E.R.

N87-14388*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SSM ATOMIC OXYGEN REACTIONS ON KAPTON AND SILVERIZED TEFLON
Roger Linton and Ann Whitaker *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 265-272 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Surface morphology studies using scanning electron microscopy on Kapton and Inconel silver coated Teflon material samples retrieved from the Solar Maximum Mission spacecraft revealed significant changes attributed to orbital atomic oxygen induced reactions. The Kapton recession observed on the aluminized Kapton material samples appeared equivalent in nature with that observed on previous Space Shuttle LEO missions. SSM Teflon taped material samples, coated on the back side with films of Inconel protected silver were observed degraded on both sides. Visibly severe reactions on the back side produced total blackening, generally restricted to areas of tape with a narrow direct view-factor of the external orbital environment. High magnification scanning electron microscope views provided evidence of near total silver reaction, flaking, and subsequent erosion of the underlying Teflon itself. Only three of the extensive S.E.M. photographs illustrating the basic reactions observed are included pending further detailed investigations. E.R.

N87-14389*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY RESULTS OF SMM EXPOSED ALUMINIZED KAPTON AND SILVERED TEFLON
Beatrice Santos-Mason *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 273-286 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Early Space Shuttle flights revealed that organic materials, such as those used in thermal control blankets and paints in the payload bay, were adversely affected in the low Earth orbit environment. Examination of eroded surfaces on these early flights and materials experiments performed on subsequent flights led to the conclusion that atomic oxygen present at Shuttle operating altitudes was responsible for surface degradation. The Solar Maximum Mission provided surfaces that had been exposed in real time to atomic oxygen and ultraviolet radiation. Preliminary results of studies of the microscopic surface effects on silvered Teflon and aluminized Kapton used for thermal control on the Solar Maximum Mission are presented. E.R.

N87-14390*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TEFLON, KAPTON SURFACE AND BULK EFFECTS
J. C. Robinson and M. McCargo *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 287-316 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Two samples of 2 mil aluminized/Kapton thermal blanket and two samples of Teflon were received for evaluation. Their location on the solar maximum is given. The Kapton top layer of the thermal blanket had been exposed to the LEO atomic oxygen environment and shows the surface degradation due to atomic oxygen attack resulting in a diffuse character over most of the surface. The backside Kapton layer which was unexposed appeared to the eye to be in virgin condition. Another sample exhibited similar properties, but was, in large part, covered with Kapton adhesive tape and it was not possible to obtain usable specimens for analysis. One of the Teflon samples which was exposed shows signs of heavy degradation including attack on the Ag/Inconel backside by ultraviolet and atomic oxygen. The other Teflon sample which was unexposed was only slightly fogged on the Teflon side and the Ag/Inconel appeared untouched. These samples were subjected to several chemical and physical analyses, the results of which are discussed. E.R.

N87-14391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF NORMAL AND TRANSPARENT SILVER TEFLON
Wayne K. Stuckey, Alan A. Galuska, and Joe Uht *In its* Proceedings of the SMRM Degradation Study Workshop 1985 p 317-336 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

Samples of Inconel/silver/Teflon exposed to solar radiation, and atomic oxygen on Solar Max were microcharacterized. Those samples exposed to atomic oxygen from the metallic side had become transparent while those exposed from the Teflon side remained reflective. The difference between the transparent and non-transparent material was determined. Microcharacterization of these Inconel/silver/Teflon samples was performed using scanning electron microscopy with windowless energy dispersive X ray analysis, secondary ion mass spectrometry, and X ray photoelectron spectroscopy. Author

N87-14392*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Technology Section.
DEGRADATION STUDIES OF SMRM TEFLON
Ranty H. Liang, Keri L. Oda, and Shirley Y. Chung *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 337-342 (For primary document see N87-14374 06-18)
Avail: NTIS HC A16/MF A01 CSCL 22B

A working group was organized to study materials and components of the Solar Max Satellite (SMS) that was returned by the STS 41C. These materials were exposed in space for 50 months and represent the only real time long term exposure data available to date. In the molecular modeling of material and energetic oxygen atom interaction, it is pointed out that the importance of developing correlation between accelerated exposure data from STS and some real time data. In particular, it was predicted that Teflon which showed no detectable degradation on various STS flights may be susceptible to atomic oxygen degradation under real time conditions. Initial inspection of returned SMS samples showed that Teflon suffered visual damage such as

cracking and yellowing. The results of examination of these samples are given. Author

N87-14393*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Spacecraft Thermodynamics.

SOLAR MAXIMUM THERMAL SURFACE ASSESSMENT

G. D. Rhoads *In* NASA. Goddard Space Flight Center Proceedings of the SMRM Degradation Study Workshop 1985 p 343-355 (For primary document see N87-14374 06-18)

Avail: NTIS HC A16/MF A01 CSCL 22B

The inflight repair of the Solar Maximum Spacecraft provided the first opportunity to make actual measurements of thermal control surfaces after 4 years exposure in low Earth orbit. Defective hardware was replaced by astronauts and returned to Earth while protected from reentry damage in the Shuttle Payload bay. A preliminary thermal surface assessment was made soon after retrieval in support of Space Telescope and other current spacecraft programs. This included visual examination and measurement of Kapton and Teflon film to determine change in thermal radiative properties after 4 years exposure to solar radiation and reaction with atomic oxygen. Comparative measurements were made with a portable solar reflectometer used for inspection of spacecraft hardware. Post flight measurements and observations reveal significant surface changes that further confirm Kapton mass loss predictions made prior to Solar Maximum repair. Details of thermal surface application, measurements and experimental results are presented and discussed. Author

N87-14394# European Space Agency, Paris (France).

PROCEEDINGS OF AN INTERNATIONAL SYMPOSIUM ON FLUID DYNAMICS AND SPACE

W. R. Burke, comp. Aug. 1986 205 p Symposium held in Rhode-Saint-Genese, Belgium, 25-26 Jun. 1986; organized by ESA, and the Von Karman Inst. for Fluid Dynamics

(ESA-SP-265; ISSN-0379-6566; ETN-87-98893) Avail: NTIS HC A10/MF A01

Reentry aerothermodynamics; rocket engines; spacecraft environments; and fluid dynamic experiments in space were discussed. For individual titles, see N87-14395 through N87-14412.

N87-14395# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).

PREDICTION METHODS FOR THE CALCULATION OF FLOW FIELDS AROUND REENTRY VEHICLES

C. Weiland *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 3-11 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

Aerothermodynamic prediction methods for hypersonic flight vehicles are considered, particularly three dimensional integration methods for the Euler and the Navier-Stokes equations. Time-marching and space-marching finite difference algorithms are applied for blunt body or pure supersonic flow regimes, respectively. Results for supersonic and hypersonic freestream Mach numbers are given. Calculation of the boundary layer flow using an integral method around a missile configuration is discussed. Results show the beginning of flow separation on the leeward side. The necessity to consider the real gas effects for the different supersonic and hypersonic flow regimes is emphasized. ESA

N87-14396# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. for Experimental Fluid Mechanics.

LABORATORY SIMULATION OF THE REAL GAS EFFECTS OF REENTRY

Hans Hornung *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 13-19 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

Real-gas effects that occur because of dissociation and ionization of air during reentry of a vehicle into the Earth's atmosphere are considered. The nonrealizability of complete simulation of such flows in the laboratory and the need to test mathematical models by partial simulation are discussed. An argument leading to the free-piston-driven shock tunnel as a suitable facility for providing such partial simulation is presented. Results obtained in such a facility and a justification for the non-reflected-shock version of the machine are given. The value of the data obtainable from the free-piston shock tunnel to programs being planned in Europe and the USA is emphasised. ESA

N87-14397# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

VEHICLE GEOMETRY EFFECTS ON HYPERSONIC STABILITY AND CONTROL

R. A. East and G. R. Hutt *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 21-29 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

Features of vehicle design which determine aerodynamic stability and control in continuum hypersonic flow are described. The features associated with the dominant nose flow field generator are demonstrated for a family of cones. The effects on vehicle static and dynamic stability due to length to diameter ratio, flare, and fin (wing) effectiveness are identified with emphasis on viscous flow field interference. Techniques of hypersonic vehicle control are reviewed. The high effectiveness of control systems located within the nose flow field generator area is demonstrated by data obtained for a blunted cone augmented with a forward facing aerodynamic spike. ESA

N87-14398# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

EXTENDABLE NOZZLE FOR THE HM60 ROCKET ENGINE c20

Walter Oechslein *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 33-40 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

The application of an extendable nozzle to increase the performance of a thrust chamber at high altitudes was investigated. It is not possible to design one nozzle which can operate efficiently from sea level to orbit conditions. The obvious advantage of a two-position nozzle is the capability of adapting better to the ambient pressure conditions, which results in a considerable performance increase; an increase of delta I sp = 15 to 20 s appears feasible. From a performance standpoint, the optimum area ratio of the extendable nozzle is estimated to be 130 for the metallic nozzle/extension structure, and 150 to 170 for a carbon/carbon fiber design. The application of carbon/carbon fiber material results in a considerable performance increase potential. The most feasible cooling method of the extendable nozzle is a combination of film and radiation cooling. ESA

N87-14399# Centre National d'Etudes Spatiales, Paris (France). Direction des Lanceurs.

FLUID DYNAMIC PROBLEMS IN THE HM60 (VULCAIN) CRYOGENIC TURBOPUMP c37

G. Albano and P. Pempie *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 41-46 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

The most important fluid dynamic problems to be solved in the development of the HM60 (Vulcain) engine turbopumps are described. The engine will be used to power the central core of Ariane 5. The greatest difficulties concern cavitating flows, high Reynolds number flows, and the supersonic turbines. ESA

N87-14400# Volvo Flygmotor A.B., Trollhaettan (Sweden).

AERODYNAMIC DESIGN AND TEST OF A SUPERSONIC TURBINE FOR A ROCKET ENGINE c20

Ulf Haal *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 47-53 (For primary document see N87-14394 06-18)

Avail: NTIS HC A10/MF A01

The cryogenic Vulcain engine turbopumps for Ariane 5 are described. The two turbopumps are driven by one turbine each arranged in parallel. The turbine for the LOX turbopump is a supersonic, one-stage, full admission turbine with a total to static pressure ratio of 26 for the stage. The aerodynamic loading of the stage is high with a turning in the rotor of greater than 130 deg. The Mach number level in the turbine is 2. Tests of the stage shown a turbine almost running as expected from the layout. The efficiency is close to specified, and the turbine shows good performance in the whole operating range. ESA

N87-14401# Grenoble-1 Univ. (France). Centre de Recherches et d'Essais de Machines Hydrauliques.
PARTIAL CAVITATION ON PUMP BLADES c34
J. L. Schultz and J. L. Kueny *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 55-62 Sponsored by CNES (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

A method for modeling partial cavitation on pump blades is presented. The blade to blade flow field is analyzed by a finite element method on triangular elements with three nodes. The boundary conditions on the suction side of the blade are reformulated to take account of a constant pressure cavity. An iterative relaxation technique of the boundary gives the shape of the cavity and the inner pressure at convergence. Applications of the method to several geometries are presented. ESA

N87-14402# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
FLUID DYNAMIC PROBLEMS IN SPACE SYSTEMS c34
E. Slachmuylders, W. Berry, D. N. Soo, and C. Savage *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 65-82 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

Applications of fluid systems on spacecraft for propulsion, thermal control, and nutation damping are reviewed. Design problems posed by the high vacuum, microgravity environment of space and the dynamic interaction effects between the fluid systems and the spacecraft dynamic motion are discussed. Propellant management and tankage technology for operation in microgravity; liquid (propellants and cryogenic helium and hydrogen coolants) slosh interactions on spacecraft attitude control; control system rocket engine exhaust plume impingement effects; active thermal control systems using fluids; passive nutation damping using fluids; leak detection techniques for pressurized fluid systems operating in high vacuum; propellant contents gaging in microgravity; refuelling in orbit; and aerodynamic drag effects in low Earth orbits are considered. ESA

N87-14403# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. For Experimental Fluid Mechanics.
ROCKET EXHAUST PLUME FLOW INTO SPACE c20
G. Koppenwallner, R.-D. Boettcher, G. Dettleff, and H. Legge *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 83-88 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

An analytical plume flow model, which allows the incorporation of experimental results is presented. The model is an extension of Boynton's (1967) approach. The flow field is first subdivided into two regions with gas of different history in the nozzle, namely the core emanating from the inviscid nozzle core and the gas emanating from the nozzle boundary layer. In both regions the expanding gas behaves initially like a continuum. Due to increasing flow rarefaction and a lack of intermolecular collisions, the continuum behavior breaks down and a transition to the free molecular expansion in the far field takes place. Therefore continuum, transition, and free molecular gas behavior, in addition to the core and boundary layer regions, determine another set of distinct flow regions in the plume. Each flow field region needs its appropriate modeling. ESA

N87-14404# Centre National de la Recherche Scientifique, Meudon-Bellevue (France). Lab. d'Aerothermique.
DYNAMIC ASPECTS OF ROCKET PLUME IMPINGEMENT c20
J. C. Lengrand, J. Allegre, and M. Raffin *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 89-95 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

Methods to predict the dynamic effects of impingement of rocket plumes on spacecraft structures are reviewed. Criteria used to estimate the degree of rarefaction of the flow field are discussed. A combination of the widely used Newtonian approximation with a correlation of experimental results is proposed for a better prediction of pressure distribution in the continuum regime. ESA

N87-14405# Technische Univ., Hamburg (West Germany).
ROCKET PLUME CONTAMINATION AND SURFACE INTERACTION EFFECTS c20
H. Trinks *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 97-108 Sponsored by ESA/ESTEC (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

Investigations were performed to obtain experimental data on the structure, composition, contaminants, and impingement of plumes (particularly from bipropellant thrusters burning nitrogen tetroxide and monomethyl hydrazine propellants) that would be useful in improving the determination of plume effects on spacecraft performance. The experiments were conducted with real engine firings in a high vacuum test facility, using mass spectrometry, heat flux sensors, short time photography, optical scatter, and surface resistivity measurements. The nature of the contaminant deposition process on different surface materials, and surface properties change, particularly in connection with optical transmission, scatter effects, and electrical surface resistivity are discussed. ESA

N87-14406# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FORCED MOTION ON SPINNING TEST FOR SLOSH-MOMENT INVESTIGATIONS
J. P. Guibert *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 109-117 (For primary document see N87-14394 06-18)
(Contract ESTEC-5327/83)
Avail: NTIS HC A10/MF A01

A test facility for experiments on the attitude stability of spinning spacecraft containing propellant tanks was developed. The test principle consists in subjecting scale model tanks to a steady coning motion of small amplitude, then in determining the steady moment exerted in response by liquid slosh against the tank walls, and in using this moment properly scaled back to real tank conditions, to predict the spacecraft nutation divergence rate. Results for a configuration with four cylindrical tanks with hemispherical ends, located apart from spin axis are reported. ESA

N87-14407# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
MONODISPERSE DROPLET STREAMS AND THEIR APPLICATION IN SPACE c34
K. Anders *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 119-125 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

The instability of the surface of a laminar liquid jet, leading to a disintegration of the jet into single droplets is discussed. If the jet is excited by an appropriate frequency, this disintegration can be controlled and a stream of monodisperse droplets of a very high uniformity is obtained. The droplets all have the same size and a constant spacing. Droplet diameter velocity, and spacing can be adjusted by the operation parameters of the droplet generator. Applications and experiments using droplet streams are presented. Such systems of monodisperse droplets are powerful tools for the calibration of commercially available particle sizing instruments. Liquid droplet radiators to remove waste heat in space

are discussed. They are of great interest due to their lightweight potential compared to conventional solid surface radiators using fins or heat pipes. ESA

N87-14408# National Aerospace Lab., Amsterdam (Netherlands).
OBSERVATIONS ON BEHAVIOR OF LIQUID IN WEIGHTLESSNESS c29
J. P. B. Vreeburg *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 129-136 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

Microgravity science disciplines are outlined, and fluids experiments in space are reviewed. Capillary liquid dynamics experiments for the Spacelab fluid physics module are listed. ESA

N87-14409# Vrije Universiteit, Brussels (Belgium). Dept. of Chem. Physics.
SURFACE TENSION MINIMUM AND MARANGONI CONVECTION c29
J. C. Legros, M. C. Limbourg-Fontaine, and G. Petre *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 137-143 Sponsored by SPPS, Fonds National de la Recherche Fondamentale Collective, La Loterie Nationale, Banque Nationale, Fonds National de la Recherche Scientifique, Fondation Univ. A et D Van Buren, and the Commission de la Recherche de l'Univ. Libre de Brussels, Belgium (For primary document see N87-14394 06-18)
(Grant NATO-916-83)
Avail: NTIS HC A10/MF A01

Thermocapillary movements in systems having a surface tension which presents at equilibrium a minimum temperature were studied. Experiments were performed during the Texus 8 and Texus 9 flights of high altitude rockets to investigate convection at the lateral boundaries of the interface of an aqueous solution of n-heptanol presenting a minimum of surface tension. The short duration of sounding rocket flights does not permit reaching steady state. This steady state was studied during the D1 mission of Spacelab (experiment WL-FPM 05). ESA

N87-14410# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
PRELIMINARY RESULTS FROM THE EMTE FUEL SLOSH FLIGHT EXPERIMENT c34
G. Netter and H.-G. Beig *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 145-157 (For primary document see N87-14394 06-18)
(Contract ESTEC-6419/85-NL-AN(SC))
Avail: NTIS HC A10/MF A01

A fluid dynamics experiment with a surface tension tank was flown on STS-16 to study liquid behavior in a partially filled surface tension tank under microgravity conditions. Results show that for a TV-Sat type propellant tank, there exists only one stable interface configuration. The prediction of the interface configuration for radial acceleration is, in the case of TV-Sat configuration, a valid approximation. The expulsion efficiency is equal to predicted. In sloshing with small amplitudes, nonlinear terms of the equations of motion can be neglected. For sloshing with large amplitude, nonlinear effects must be regarded, but the results can still be derived from small amplitudes by correction terms from experimental results. For movement in bulks, the dynamic effects are fundamentally different and results cannot be derived from the motion with small amplitudes. ESA

N87-14411# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HEAT PIPE EXPERIMENT ON SPAS 01 c34
H. Kock, H. Kreeb, and C. Savage (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 159-173 Sponsored by BMFT and ESA (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

The second flight of Challenger carried a heat pipe experiment, designed to measure the performance of constant conductance heat pipe diodes over a period of 16 hr. The experiment platform and the flight results on variable conductance heat pipe housekeeping radiators, including the temperature distribution at these heat pipe versus experiment time are presented. All equipment is shown to be space qualified. ESA

N87-14412# Advanced Propulsion and Energy Control Systems Ltd., Hauts (England).
BASE PRESSURE CONTROL FOR AEROSPACE VEHICLES c20
L. H. Townend and J. A. Edwards (Cambridge Univ., England) *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 177-188 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

The fluid dynamics of base pressurization and thrust of rocket propelled vehicles, and the possibility of controlling base pressure so as to enhance propulsive performance during launch are discussed. One method of control consists of manipulating the interaction(s) of wakes and shock waves which already occur on the vehicle. Others involve elaborations such as base bleed, wake combustion, and flame-shock interactions, deliberately introduced into the airflows downstream of the vehicle. ESA

N87-14413*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SYNCHRONOUSLY DEPLOYABLE DOUBLE FOLD BEAM AND PLANAR TRUSS STRUCTURE Patent Application
Marvin D. Rhodes, inventor (to NASA) and John M. Hedgepeth, inventor (to NASA) Filed 22 Aug. 1986 14 p
(NASA-Case-LAR-13490-1; NAS 1.71:LAR-13490-1; US-Patent-Appl-SN-899683) Avail: NTIS HC A02/MF A01 CSCL 84G

A deployable structure that synchronously deploys in both length and width is disclosed which is suitable for use as a structural component for orbiting space stations or large satellites. The structure is designed with maximum packing efficiency so that large structures may be collapsed and transported in the cargo bay of the Space Shuttle. The synchronous deployment feature allows the structure to be easily deployed in space by two astronauts, without a complex deployment mechanism. The structure is made up of interconnected structural units, each generally in the shape of a parallelepiped. The structural units are constructed of structural members connected with hinged and fixed connections at connection nodes in each corner of the parallelepiped. Diagonal members along each face of the parallelepiped provide structural rigidity and are equipped with mid-length, self-locking hinges to allow the structure to collapse. The structure is designed so that all hinged connections may be made with simple clevis-type hinges requiring only a single degree of freedom, and each hinge pin is located along the centerline of its structural member for increased strength and stiffness. NASA

N87-14414# Massachusetts Inst. of Tech., Lexington.
THE SOLAR SHIELD: A THERMALLY INSULATING, BROADBAND, ELECTROMAGNETIC WINDOW FOR SATELLITES
Marcia S. Powell, David M. Nathanson, and Edward B. Murphy 2 Jun. 1986 53 p
(Contract F19628-85-C-0002)
(AD-A170334; TR-742; ESD-TR-85-324) Avail: NTIS HC A04/MF A01 CSCL 22/2

A space qualified, thermally insulating, broad-band, electromagnetic window for satellite applications is described. A multiple layer construction is used, with each layer consisting of quartz fiber paper sandwiched between two sheets of Kapton. The measured insertion loss is less than 0.25 dB at frequencies up to 50 GHz. When exposed to full solar radiation (127 W/sq ft.), about W/sq ft. are transferred through the thickness of the window into a 20 C background in the interior of the satellite. Under eclipse conditions, about 3 W/sq ft. are radiated from the satellite into the cold space background compared with nearly 40 W/sq ft

without the window. The reasons for this performance are explained, and detailed descriptions of the experimental evaluations are given. A brief summary of the space-qualification testing is also included. GRA

N87-14415# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A METHOD FOR GOVERNING SPACECRAFT EVASIVE MANEUVERING M.S. Thesis
Keith R. Keller Jun. 1986 251 p
(AD-A170896; AFIT/CI/NR-86-89T) Avail: NTIS HC A12/MF A01 CSCL 22/3

In this paper, I will describe research I conducted to develop a method for governing spacecraft evasive maneuvering through a computer program incorporating many of the techniques of astrodynamics. Because of the critical time constraints prevailing in a typical intercept scenario, a means of providing information top the spacecraft concerning the predicted position of the missile and the transfer time-to-intercept is required. I intend to show that the methods of astrodynamics can provide the timely, accurate information needed by the spacecraft to predict intercept and calculate velocity-to-be-gained requirements to achieve a miss-distance of a desired magnitude and direction at the predicted intercept time. These calculations will be based on two vector position fixes of the missile over time, which could be obtained from an infrared detector and a laser-rangefinder, and the position and velocity vectors of the spacecraft, as could be obtained from on-board guidance and navigation instruments. GRA

N87-14416# Naval Postgraduate School, Monterey, Calif.
SATELLITE ORBIT PROGRAMS UTILIZING THE GRAPHICS CAPABILITIES OF THE MICROCOMPUTER M.S. Thesis
Kim A. Langdorf Jun. 1986 75 p
(AD-A172485) Avail: NTIS HC A04/MF A01 CSCL 22/3

It is important for a student of Space Science to have the opportunity to thoroughly understand the principle of an artificial satellite orbit. This thesis consists of four computer graphics programs that will enable the student to see what an orbit is and how it works. The first program demonstrates the shape of an orbit is and how it works. The first program demonstrates the shape of an orbit in two dimensions resulting from initial altitude, speed, and flight path angle. The second program draws an orbit in three dimensions around a sphere based on the input of the classical orbital elements. The third program traces the ground track of a satellite over a map of the Earth. And the fourth plots the ground track of a geosynchronous satellite over a map of the Earth. The student can learn about orbits by entering the orbital elements and viewing the resultant orbit. GRA

N87-14417# Sandia National Labs., Albuquerque, N. Mex.
EFFECTS OF AN ELECTRONIC COMPONENT RADIATION QUALIFICATION PROGRAM ON SATELLITE LONGEVITY AND SHIELDING
M. R. Ackermann and G. S. Jolly, III 1986 6 p Presented at the 5th International Conference on Reliability and Maintainability, Biarritz, France, 6 Oct. 1986 Prepared in cooperation with Air Force Weapons Lab., Kirtland AFB, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-011093; SAND-86-1140C; CONF-861027-1) Avail: NTIS HC A02/MF A01

Current electronic component radiation qualification test methods are believed to seriously underestimate component radiation hardness, and hence, underestimate a satellite's longevity in the natural space radiation environment. Recent research shows several problems with the current test techniques and indicates that linear systems theory may not be applicable to predicting low dose rate response from high dose rate laboratory data. Analysis of published data and use of a simple computer model suggest that high dose rate laboratory test data may actually overestimate low dose rate component survivability. DOE

N87-14418# Three-K Akustikbyran A.B., Stockholm (Sweden).
MAGNITUDE EQUIVALENCE OF RANDOM LOADS AND SUPERPOSITION WITH TRANSIENT EXCITATIONS Final Report
O. Bennerhult, S. Hammarlund, F. Nilsson, O. Sylwan, and L.-A. Samuelsson Paris, France ESA Sep. 1985 140 p
(Contract ESA-5461/83)
(TR-5.338; ESA-CR(P)-2264; ETN-86-98145) Avail: NTIS HC A07/MF A01

Methods to predict design loads in spacecraft payloads when combination of transient and random loads is important were studied. A closed form probabilistic expression which describes the statistical distribution of the magnitude equivalence was developed, and was verified through computer simulations and experiments. The presently used and the developed method were compared using recorded vibration time histories from STS-flights. The results indicate that the presently used methods produce design loads which correspond to risks of failure of typically 1% to 2%, and higher. Commonly used safety factors (1.2 to 1.5) however in most cases reduce the risk to less than 0.135%. It is recommended that the developed probabilistic method is included in the design procedures, or that presently used methods are revised. ESA

N87-14419# SATCOM International, Paris (France).
COMPARISON OF FUTURE COMMUNICATIONS SPACE SEGMENT CONCEPTS Final Report
P. Molette, Ph. Saint-Aubert, C. Cougnet, B. Claudinon, R. W. Young, J. Murdoch, and D. Helas Toulouse, France Matra Espace Sep. 1982 414 p
(Contract ESA-4818/81-NL-MD)
(DM51-C/PM/FL/0100.82; ESA-CR(P)-2011-Vol-1; ETN-87-98643)
Avail: NTIS HC A18/MF A01

A large platform, which can be assembled either in geostationary orbit (resulting in several launches, rendezvous and docking), or in low Earth orbit by using the STS; and a cluster of satellites, designed to meet the requirements of a communication mission were compared. They are characterized by the required number of modules to be launched, the type of launcher, and subsystems or equipments to be developed. The concepts are evaluated following technical criteria such as adaptability to other missions, flexibility, and growth potential. A cost/benefit evaluation of each solution is presented. The concepts are compared as to the technical/economical attractiveness of each solution. The critical elements of the concepts are pointed out and lead to the analysis of a possible demonstration mission. ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N87-14420* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW LOSS INJECTOR FOR LIQUID PROPELLANT ROCKET ENGINES Patent
George L. vonPragenau, inventor (to NASA) Issued 11 Nov. 1986 10 p
(NASA-Case-MFS-25989-1; US-Patent-4,621,492;

US-Patent-Appl-SN-690273; US-Patent-Class-60-258; US-Patent-Class-60-746; US-Patent-Class-239-132.5; US-Patent-Class-239-425; US-Patent-Class-239-403) Avail: US Patent and Trademark Office CSCL 21H

A low pressure loss injector element is disclosed for the main combustion chamber of a rocket engine which includes a lox post terminating in a cylindrical barrel. Received within the barrel is a lox plug which is threaded in the lox post and includes an interchangeable lox metering sieve which meters the lox into an annular lox passage. A second annular gas passage is coaxial with the annular lox passage. A cylindrical sleeve surrounds the annular gas passage and includes an interchangeable gas metering seive having metering orifices through which a hot gas passes into the annular passage. The jets which emerge from the annular lox passage and annular gas passage intersect in a recessed area away from the combustion area. Thus, mixing and combustion stability are enhanced.

Official Gazette of the U.S. Patent and Trademark Office

N87-14421# Communications Research Centre, Ottawa (Ontario).
ELECTRIC PROPULSION: A REVIEW OF FUTURE SPACE PROPULSION TECHNOLOGY
G. D. Voulelikas Oct. 1985 77 p
(CRC-1396) Avail: NTIS HC A05/MF A01

The various types of electric thrusters that have been developed for both primary and auxilary propulsion are discussed. Details of the principal characteristics of the most promising and currently developed devices along with the advantages and disadvantages of each type of thruster are also discussed. In addition, an account is given of some of the missions for which each type of electric propulsion system is suited, concentrating on applications dealing with north-south stationkeeping (NSSK) of geostationary satellites, orbit transfer and interplanetary objectives. Finally a system configuration is discussed based on the current state-of-the-art and conclusions and recommendations are given for current and future development. E.R.

N87-14422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRIC PROPULSION OPTIONS FOR THE SP-100 REFERENCE MISSION
Terry L. Hardy, Vincent K. Rawlin, and Michael J. Patterson 1987 26 p Presented at the 4th Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 12-16 Jan. 1987; sponsored by the Inst. for Space Nuclear Power Studies
(NASA-TM-88918; E-3343; NAS 1.15:88918) Avail: NTIS HC A03/MF A01 CSCL 81G

Analyses were performed to characterize and compare electric propulsion systems for use on a space flight demonstration of the SP-100 nuclear power system. The component masses of resistojet, arcjet, and ion thruster systems were calculated using consistent assumptions and the maximum total impulse, velocity increment, and thrusting time were determined, subject to the constraint of the lift capability of a single Space Shuttle launch. From the study it was found that for most systems the propulsion system dry mass was less than 20 percent of the available mass for the propulsion system. The maximum velocity increment was found to be up to 2890 m/sec for resistojet, 3760 m/sec for arcjet, and 23 000 m/sec for ion thruster systems. The maximum thruster time was found to be 19, 47, and 853 days for resistojet, arcjet, and ion thruster systems, respectively. Author

N87-14423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE SURVIVABILITY OF LARGE SPACE-BORNE REFLECTORS UNDER ATOMIC OXYGEN AND MICROMETEOROID IMPACT
Daniel A. Gulino 1987 18 p Presented at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(NASA-TM-88914; E-3338; NAS 1.15:88914) Avail: NTIS HC A02/MF A01 CSCL 21H

Solar dynamic power system mirrors for use on space station and other spacecraft flown in low Earth orbit (LEO) are exposed to the harshness of the LEO environment. Both atomic oxygen and micrometeoroids/space debris can degrade the performance of such mirrors. Protective coatings will be required to protect oxidizable reflecting media, such as silver and aluminum, from atomic oxygen attack. Several protective coating materials have been identified as good candidates for use in this application. The durability of these coating/mirror systems after pinhole defects have been inflicted during their fabrication and deployment or through micrometeoroid/space debris impact once on-orbit is of concern. Studies of the effect of an oxygen plasma environment on protected mirror surfaces with intentionally induced pinhole defects have been conducted at NASA Lewis and are reviewed. It has been found that oxidation of the reflective layer and/or the substrate in areas adjacent to a pinhole defect, but not directly exposed by the pinhole, can occur. Author

N87-14424*# Aerojet TechSystems Co., Sacramento, Calif.
DUAL-THROAT THRUSTER THERMAL MODEL Final Report
R. L. Ewen, C. J. OBrien, and L. W. Matthews Aug. 1986 465 p
(Contract NAS8-34136)
(NASA-CR-178975; NAS 1.26:178975; Rept-34136F; Rept-BB0216) Avail: NTIS HC A20/MF A01 CSCL 21H

The dual-throat engine is one of the dual nozzle engine concepts studied for advanced space transportation applications. It provides a thrust change and an in-flight area ratio change through the use of two concentric combustors with their throats arranged in series. Test results are presented for a dual throat thruster burning gaseous oxygen and hydrogen at primary (inner) chamber pressures from 380 to 680 psia. Heat flux profiles were obtained from calorimetric cooling channels in the inner nozzle, outer or secondary chamber and the tip of the inner nozzle. Data were obtained for two nozzle spacings over a chamber pressure ratio (secondary/primary) range of 0.45 to 0.83 with both chambers firing (Mode I). Fluxes near the end of the inner nozzle were significantly higher than in Mode II when only the inner chamber was fired, due to the flow separation and recirculation caused by the back pressure imposed by the secondary chamber. As the pressure ratio increased, these heat fluxes increased and the region of high heat flux relative to Mode II extended farther upstream. The use of the gaseous hydrogen bleed flow in the secondary chamber to control heat fluxes in the primary plume attachment region was investigated in Mode II testing. A thermal model of a dual throat thruster was developed and upgraded using the experimental data. Author

N87-14425*# Page (R. J.) Co., Santa Ana, Calif.
A DESIGN STUDY OF HYDRAZINE AND BIOWASTE RESISTOJETS Final Report
Russell J. Page, Willis A. Stoner, and Larry Barker Sep. 1986 149 p
(Contract NAS3-23863)
(NASA-CR-179510; NAS 1.26:179510) Avail: NTIS HC A07/MF A01 CSCL 21H

A generalized modeling program was adapted in BASIC on a personal computer to compare the performance of four types of biowaste resistojets and two types of hydrazine augmenters. Analyzed biowaste design types were: (1) an electrically conductive ceramic heater-exchanger of zirconia; (2) a truss heater of platinum in cross flow; (3) an immersed bicoiled tubular heater-exchanger; and (4) a nonexposed, refractory metal, radiant heater in a central cavity within a heat exchanger case. Concepts 2 and 3 are designed to have an efficient, stainless steel outer pressure case. The hydrazine design types are: (5) an immersed bicoil heater exchanger and (6) a nonexposed radiant heater now with a refractory metal case. The ceramic biowaste resistojet has the highest specific impulse growth potential at 2000 K of 192.5 (CO_2) and 269 s (H_2O). The bicoil produces the highest augmenter temperature of 1994 K for a 2073 K heater giving 317 s at .73 overall efficiency. Detailed temperature profiles of each of the designs are shown. The scaled layout drawings of each are presented with recommended materials and fabrication methods. Author

N87-14426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID OXYGEN COOLING OF HIGH PRESSURE LOX/ HYDROCARBON ROCKET THRUST CHAMBERS
Harold G. Price and Philip A. Masters Aug. 1986 23 p
(NASA-TM-88805; E-3149; NAS 1.15:88805) Avail: NTIS HC A02/MF A01 CSCL 21H

An experimental program using liquid oxygen (LOX) and RP-1 as the propellants and supercritical LOX as the coolant was conducted at 4.14, 8.27, and 13.79 MN/sq m (600, 1200, and 2000 psia) chamber pressure. The objectives of this program were to evaluate the cooling characteristics of LOX with the LOX/RP-1 propellants, the buildup of the soot on the hot-gas-side chamber wall, and the effect of an internal LOX leak on the structural integrity of the combustor. Five thrust chambers with throat diameters of 6.6 cm (2.5 in.) were tested successfully. The first three were tested at 4.14 MN/sq m (600 psia) chamber pressure over a mixture ratio range of 2.25 to 2.92. One of these three was tested for over 22 cyclic tests after the first through crack from the coolant channel to the combustion zone was observed with no apparent metal burning or distress. The fourth chamber was tested at 8.27 MN/sq m (1200 psia) chamber pressure over a mixture range of 1.93 to 2.98. The fourth and fifth chambers were tested at 13.79 MN/sq m (2000 psia) chamber pressure over a mixture ratio range of 1.79 to 2.68. Author

N87-14427*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH- AND LOW-THRUST PROPULSION SYSTEMS FOR THE SPACE STATION
Robert E. Jones 1987 23 p Presented at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(NASA-TM-88877; E-3285; NAS 1.15:88877) Avail: NTIS HC A02/MF A01 CSCL 21H

The purpose of the Advanced Development program was to investigate propulsion options for the space station. Two options were investigated in detail: a high-thrust system consisting of 25 to 50 lbf gaseous oxygen/hydrogen rockets, and a low-thrust system of 0.1 lbf multipropellant resistojets. An effort is also being conducted to determine the life capability of hydrazine-fueled thrusters. During the course of this program, studies clearly identified the benefits of utilizing waste water and other fluids as propellant sources. The results of the H/O thruster test programs are presented and the plan to determine the life of hydrazine thrusters is discussed. The background required to establish a long-life resistojet is presented and the first design model is shown in detail. Author

N87-14428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF RESISTOJET PLUMES
Lynette M. Zana, David J. Hoffman, Loranell R. Breyley (Akron Univ., Ohio), and John S. Serafini Jan. 1987 22 p Presented at the 25th Aerospace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(NASA-TM-88852; E-3243; NAS 1.15:88852) Avail: NTIS HC A02/MF A01 CSCL 21H

As a part of the electrothermal propulsion plume research program at the NASA Lewis Research Center, efforts have been initiated to analytically and experimentally investigate the plumes of resistojet thrusters. The method of G.A. Simons for the prediction of rocket exhaust plumes is developed for the resistojet. Modifications are made to the source flow equations to account for the increased effects of the relatively large nozzle boundary layer. Additionally, preliminary mass flux measurements of a laboratory resistojet using CO_2 propellant at 298 K have been obtained with a cryogenically cooled quartz crystal microbalance (QCM). There is qualitative agreement between analysis and experiment, at least in terms of the overall number density shape functions in the forward flux region. Author

N87-14429# Societe Europeenne de Propulsion, Vernon (France).
FIELD EMISSION ELECTRIC PROPULSION. INDUSTRIAL DEVELOPMENT OF EMITTERS MODULES, PHASE 1B Final Report
J. P. Bugeat, J. Macaigne, and D. Valentian Paris, France ESA 17 Mar. 1986 118 p
(Contract ESA-3724/78-NL-JS)
(TS/SL/194/DV/30.094/82; ESA-CR(P)-2181; ETN-87-98647) Avail: NTIS HC A06/MF A01

The best outgassing procedure and surface wetting treatment of a field emission electric propulsion system were defined in tests. Results confirm that vacuum outgassing with high conductance is the only viable method. The fact that same emitters were used in two series of tests shows the ruggedness of the devices. The clustering tests were successfully accomplished, showing the possibility to operate only one emitter, and showing the adding of currents and the superimposition of each beamlet. This means that no beam interaction occurs. During these tests the beam divergence and V-I characteristics were very close to the ones obtained at ESTEC with measured efficiencies of 50% to 80%. Although mass consumption was not exactly measured, it is concluded that efficiency was also very high during clustering test. ESA

N87-14430# European Space Agency, Paris (France).
ANALYSIS AND OPTIMIZATION OF SMALL SPACE SHUTTLE PROPULSION PLATFORMS
Detlef Manski Jul. 1986 242 p Original language document was announced as N85-19023
(ESA-TT-901; DFVLR-FB-84-28; ETN-87-98812) Avail: NTIS HC A11/MF A01; original German version available from DFVLR, Cologne, West Germany DM 63

Analytical models for analyzing the transportation of payloads from space shuttles were developed. The models include calculation of the structural mass of transfer stages in different configurations, the mass of rocket engines, rocket propellant performance, and the cost of upper rocket stages. A trajectory model allows mission analyses to be carried out. For the parametric representation of the results, the costs are selected as variable. Optimum space shuttle propulsion platforms are defined for three mission profiles. For minimum velocity requirements, this propulsion platform is characterized by an isotensoidal tank, hydrazine, and a super blowdown feed system. In order to verify the proposed concept, experimental investigations were carried out. Technological components are described. ESA

N87-14431# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensgruppe Raumfahrt.
COMBINED SPACECRAFT PROPULSION SYSTEMS [KOMBINATIONSANTRIEBE FUER RAUMFLUGZEUGE]
H. Hopmann, G. Schmidt, and W. Schmidt 1986 36 p In GERMAN Presented at the Symposium Gefluegelte Raumfahrzeuge 2, Hanover, West Germany, 6 Jun. 1986; sponsored by Hermann-Oberth-Gesellschaft e.V.
(ETN-87-98864) Avail: NTIS HC A03/MF A01

The realization possibilities of alternative combined propulsion system configurations for spacecraft which horizontally take off and land and have a payload capacity of 10t for low Earth orbits, are discussed. It is shown that the combined system with air breathing booster phase in which the aspirated air flow is cooled by the liquid hydrogen fuel is technically feasible. In order to obtain the required thrust density during the starting phase it is necessary to synchronize the rocket engine part on the ground, indicating a crucial point of this development, namely the control of the different operating conditions during the cooperation between the air breathing turboramjet part and the integrated turborocket part. It is demonstrated that the basic technological competence is available in Europe. ESA

N87-14398# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EXTENDABLE NOZZLE FOR THE HM60 ROCKET ENGINE
Walter Oechslein *In* ESA Proceedings of an International Sympo-

sium on Fluid Dynamics and Space Aug. 1986 p 33-40 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14400# Volvo Flygmotor A.B., Trollhaettan (Sweden).
AERODYNAMIC DESIGN AND TEST OF A SUPERSONIC TURBINE FOR A ROCKET ENGINE
Ulf Haal *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 47-53 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14403# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. For Experimental Fluid Mechanics.
ROCKET EXHAUST PLUME FLOW INTO SPACE
G. Koppenwallner, R.-D. Boettcher, G. Dettleff, and H. Legge *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 83-88 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14404# Centre National de la Recherche Scientifique, Meudon-Bellevue (France). Lab. d'Aerothermique.
DYNAMIC ASPECTS OF ROCKET PLUME IMPINGEMENT
J. C. Lengrand, J. Allegre, and M. Raffin *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 89-95 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14405# Technische Univ., Hamburg (West Germany).
ROCKET PLUME CONTAMINATION AND SURFACE INTERACTION EFFECTS
H. Trinks *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 97-108 Sponsored by ESA/ESTEC (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14412# Advanced Propulsion and Energy Control Systems Ltd., Hauts (England).
BASE PRESSURE CONTROL FOR AEROSPACE VEHICLES
L. H. Townend and J. A. Edwards (Cambridge Univ., England) *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 177-188 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

N87-14432*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUBSTITUTED 1,1,1-TRIARYL-2,2,2-TRIFLUOROETHANES AND PROCESSES FOR THEIR SYNTHESIS Patent Application
William B. Alston, inventor (to NASA) and Roy F. Gratz, inventor (to NASA) Filed 29 Oct. 1986 24 p
(NASA-Case-LEW-14345-1; NAS 1.71:LEW-14345-1; US-Patent-Appl-SN-924474) Avail: NTIS HC A02/MF A01 CSCL 99O

Synthetic procedures are described for tetraalkyls, tetraacids and dianhydrides substituted 1,1,1-triaryl-2,2,2-trifluoroethanes which comprises: (1) 1,1-bis(dialkylaryl)-1 aryl-2,2,2-trifluoroethane; (2) 1,1-bis(carboxyaryl)-1 aryl-2,2,2-trifluoroethane; or (3) cyclic dianhydride or diamine of 1,1-bis(dialkylaryl)-1 aryl-2,2,2-trifluoroethanes. The synthesis of (1) is accomplished by the condensation reaction of an aryltrifluoromethyl ketone with a dialkylaryl compound. The synthesis of (2) is accomplished by oxidation of (1). The synthesis dianhydride of (3) is accomplished by the conversion of (2) to its corresponding cyclic dianhydride. The synthesis of the diamine is accomplished by the similar reaction of an aryltrifluoromethyl ketone with aniline or alkyl substituted or disubstituted anilines. Also, other derivatives of the above are formed by nucleophilic displacement reactions. NASA

N87-14433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW CONDENSATION POLYIMIDES CONTAINING 1,1,1-TRIARYL-2,2,2-TRIFLUOROETHANE STRUCTURES Patent Appplication
William B. Alston and Roy F. Gratz, inventors (to NASA) Filed 29 Oct. 1986 27 p Sponsored by NASA
(NASA-Case-LEW-14346-1; NAS 1.71:14346-1; US-Patent-Appl-SN-934470) Avail: NTIS HC A03/MF A01 CSCL 07A

The invention relates to a condensation polyimide containing a 1,1,1-triaryl-2,2,2-trifluoroethane structure and other related condensation polyimides. The process for their preparation, which comprises polymerization of a cyclic dianhydride with a diamine is also covered. NASA

N87-14434*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
POLYMER PRECURSORS FOR CERAMIC MATRIX COMPOSITES Annual Contractor Report
Morton H. Litt and Kanta Kumar Dec. 1986 42 p
(Grant NAG3-446)
(NASA-CR-179562; NAS 1.26:179562) Avail: NTIS HC A03/MF A01 CSCL 11B

The synthesis and characterization of a polycyclohexasilane is reported. Because of its cyclic structure, it is anticipated that this polymer might serve as a precursor to SIC having a high char yield with little rearrangement to form small, volatile cyclic silanes, and, as such, would be of interest as a precursor to SiC composite matrices and fibers, or as a binder in ceramic processing. Several approaches to the synthesis of a bifunctional cyclic monomer were attempted; the most successful of these was metal coupling of PhMeSiCl2 and Me2SiCl2. The procedure gives six-membered ring compounds with all degrees of phenyl substitution, from none to hexaphenyl. The compounds with from 0-2 groups were isolated and characterized. The fraction with degree of phenyl substitution equal to 2, a mixture of cis and trans 1,2-; 1,3-; and 1,4 isomers, was isolated in 32 percent yield. Pure 1,4 diphenyldecamethylcyclohexasilane was isolated from the mixed diphenyl compounds and characterized. Diphenyldecamethylcyclohexasilanes were dephenylated to dichlorodecamethylcyclohexasilanes by treating with H2SO4.NH4Cl in benzene. The latter were purified and polymerized by reacting with sodium in toluene. The polymers were characterized by HPGPC, elemental analysis, proton NMR, and IR. Thermogravimetric analyses were carried out on the polymers. As the yield of residual SiC was low, polymers were heat treated to increase the residual char yield. As high as 51.52 percent residual char yield was obtained in one case.
Author

N87-14435# Office of Naval Research, London (England).
MATERIALS SCIENCE IN EUROPE Summary Report
Kenneth D. Challenger 27 Jun. 1986 9 p
(AD-A170214; ONRL-R-4-86) Avail: NTIS HC A02/MF A01 CSCL 13/8

This report covers highlights of European research in welding science and technology, composite materials, fracture mechanics, ceramics, and other specialized topics. GRA

N87-14436# Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Materials Research.
RESEARCH ACTIVITIES OF THE NATIONAL INSTITUTE FOR MATERIALS RESEARCH, 1985 Annual Report, 1 Jul. 1984 - 30 Jun. 1985
1985 163 p In ENGLISH and AFRIKAANS
(DE86-702765; CSIR-SMAT-21) Avail: NTIS (US Sales Only) HC A08/MF A01

Ceramics, electronic materials, metals, services to industry and

other organizations and research support activities are discussed. The highlights of the period are given, namely: the effect of high pressure on two-phase systems, spinel structures, elastic moduli of stabilized zirconia crystals, alumina ceramics, a fast sodium-ion conducting solid electrolyte (Nasicon), liquid phase epitaxial growth of (HgCd)Te, compositional uniformity of bulk-grown (HgCd)Te, semi-quantitative mass spectrography of Cd and Te, depth profiling of metal semiconductor interdiffusion, low resistance ohmic contacts on GaAs, studies of Fe-Mn-Al alloys, surface mechanical properties of materials, electron diffraction, a ceramic mold laboratory for investment casting of metals, grain boundary sliding in the deformation of polycrystalline copper and a theory of work-hardening in face-centered cubic metals. DOE

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials*.

N87-14437# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

PROCEEDINGS OF A STRUCTURAL MECHANICS COLLOQUIUM OF NONDESTRUCTIVE TESTING OF FIBER REINFORCED STRUCTURES

Rainer Schuetze, Wolfgang Hillger, and Joachim Block Jun. 1986 178 p In GERMAN; ENGLISH summary Colloquium held in Brunswick, West Germany, 5 Jun. 1986

(DFVLR-Mitt-86-09; ISSN-0176-7739; ETN-86-98279) Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 50

The observation of defects and their progression in carbon fiber reinforced plastics (CFRP) structures for damage mechanics analysis of primary structures in aerospace technology is treated. Nondestructive test methods, namely ultrasonic testing, acoustic emission analysis, X-ray techniques, and an optical reflection method are presented. All these techniques prove to be well suited for investigations of damage mechanics. For individual titles, see N87-14438 through N87-14441.

N87-14438# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

NONDESTRUCTIVE TESTS OF CARBON FIBER REINFORCED PLASTICS (CFRP) IN THE FRAMEWORK OF DAMAGE MECHANICS INVESTIGATIONS

Rainer Schuetze *In its* Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures Jun. 1986 p 11-27 In GERMAN; ENGLISH summary (For primary document see N87-14437 06-24)

Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 50

Nondestructive testing of CFRP structures for damage mechanics investigations is discussed. The most important requirements for nondestructive testing procedures are high resolution and high reproducibility in order to get indications even of very small changes in the material between, e.g., two load levels. Among the large number of nondestructive testing methods, the ultrasonic test, acoustic emission, X-ray techniques, and the optical reflection method were chosen. The combination of all four methods provides nearly complete information of the state of damage of the material. ESA

N87-14439# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

ULTRASONIC TESTING FOR DAMAGE ANALYSIS OF CARBON FIBER REINFORCED PLASTICS (CFRP) LAMINATES

Wolfgang Hillger *In its* Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures Jun. 1986 p 29-95 In GERMAN; ENGLISH summary (For primary document see N87-14437 06-24)

Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 50

An ultrasonic test facility based on the immersion technique was developed in order to provide a tool with a high degree of resolution and reproducibility for research on damage mechanics of CFRP laminates. A high axial and lateral resolution was obtained by using a broadband excitation of a highly damped probe and a narrow band filter in the receiver. The echo amplitude was measured by a logarithmic peak detector. The 2 mm thick CFRP specimen used for the optimization of the pulse parameters by echo and through transmission techniques contained artificially inserted delaminations. The degree of resolution was demonstrated by amplitude C-scans. The simultaneous application of echo and through transmission techniques opens the possibility of a nondestructive damage analysis in CFRP's. An accumulation of cracks causes attenuation measurable by the echo of the auxiliary reflector, while actual delaminations produce additional defect echoes. ESA

N87-14440# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

ACOUSTIC EMISSION ANALYSIS OF CARBON FIBER REINFORCED PLASTICS (CFRP)

Joachim Block *In its* Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures Jun. 1986 p 97-137 In GERMAN; ENGLISH summary (For primary document see N87-14437 06-24)

Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 50

Nondestructive analysis of CFRP structure damage using the acoustic emission technique is treated. Damage mechanisms in CFRP release acoustic emissions which can be analyzed with sensitive electronic equipment. The emissions, which essentially occur as discrete events, can be correlated to mechanical parameters with a high time resolution. The characterization and the in situ monitoring of damage progression in composites is based upon an event classification with respect to acoustic energy. With restrictions, the sources can also be located. ESA

N87-14441# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

X-RAY TESTS, MEASUREMENTS WITH AN OPTICAL REFLECTION METHOD, AND DESTRUCTIVE TESTS AS A TOOL FOR DAMAGE MECHANICS INVESTIGATIONS

Rainer Schuetze *In its* Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures Jun. 1986 p 139-175 In GERMAN; ENGLISH summary (For primary document see N87-14437 06-24)

Avail: NTIS HC A09/MF A01; DFVLR, Cologne, West Germany DM 50

Nondestructive and destructive tests to determine the state of damage in carbon fiber reinforced plastics (CFRP) are described. The X-ray technique is an appropriate means to find cracks in CFRP laminates. The high resolution of the method can only be achieved by using contrast enhancing agents. However, this may involve great problems of compatibility with the material. With the reflection grating method, out-of-plane deformations of specimen surfaces can be observed. This method can indicate the types of damage in CFRP laminates which influence the surface deformation. The distortion of the grating lines caused by the damage can be observed on-line as well as evaluated quantitatively. Destructive methods are important tools in damage mechanics investigations, for the interpretation and control of all nondestructive test results. ESA

N87-14442*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CERAMIC-CERAMIC SHELL TILE THERMAL PROTECTION SYSTEM AND METHOD THEREOF Patent Application

Salvatore R. Riccitiello, inventor (to NASA), Marnell Smith, inventor

(to NASA), Howard Goldstein, inventor (to NASA), and Norman B. Zimmerman, inventor (to NASA) Filed 14 May 1986 31 p
(NASA-Case-ARC-11641-1; NAS 1.71:ARC-11641-1; US-Patent-Appl-SN-862925) Avail: NTIS HC A03/MF A01 CSCL 11D

A ceramic reusable, externally applied composite thermal protection system (TPS) is proposed. The system functions by utilizing a ceramic/ceramic upper shell structure which effectively separates its primary functions as a thermal insulator and as a load carrier to transmit loads to the cold structure. The composite tile system also prevents impact damage to the atmospheric entry vehicle thermal protection system. The composite tile comprises a structurally strong upper ceramic/ceramic shell manufactured from ceramic fibers and ceramic matrix meeting the thermal and structural requirements of a tile used on a re-entry aerospace vehicle. In addition, a lightweight high temperature ceramic lower temperature base tile is used. The upper shell and lower tile are attached by means effective to withstand the extreme temperature (3000 to 3200 F) and stress conditions. The composite tile may include one or more layers of variable density rigid or flexible thermal insulation. The assembly of the overall tile is facilitated by two or more locking mechanisms on opposing sides of the overall tile assembly. The assembly may occur subsequent to the installation of the lower shell tile on the spacecraft structural skin. NASA

N87-14443# Oak Ridge Gaseous Diffusion Plant, Tenn.
STRESS RUPTURE OF CARBON FIBER COMPOSITE MATERIALS
J. T. Shaffer Jul. 1986 12 p Presented at the 18th Society for the Advancement of Materials and Process Engineering National Technical Conference on Materials, Seattle, Wash., 7 Oct. 1986
(Contract DE-AC05-84OT-21400)
(DE86-012854; K/TS-11789; CONF-861004-4) Avail: NTIS HC A02/MF A01

Stress rupture testing was conducted on 294 carbon fiber/epoxy composite strands. The fiber used was Hercules' IM6-12K and the epoxy was Union Carbide's ERL-2258. The tests were conducted at load levels up to 99% of the mean strength of the strands. After approximately two years of testing, the data indicated that the degradation rate for this composite system is extremely slow. This result is consistent with the premise that both the strength and life of composite systems are related to the amount and distribution of flaw sites within the composite. When structure size is properly accounted for, the high strength carbon fiber/epoxy composites should prove to be very reliable structures, even with small design margins. DOE

N87-14444# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Etudes Materiaux non Metalliques.
BEHAVIOR OF COMPOSITE MATERIALS SUBJECTED TO A THERMOHYGROMETRIC CYCLE ENVIRONMENT COMBINED WITH MECHANICAL FATIGUE. THE CASE OF A BOLTED JOINT AND PERFORATED SPECIMENS SUBJECTED TO A SUPERSONIC MILITARY AIRCRAFT TYPE MISSION, TEST REPORT [COMPORTEMENT DES MATERIAUX COMPOSITES SOUMIS A UN ENVIRONNEMENT THERMO-HYGROMETRIQUE CYCLE COMBINE A DE LA FATIGUE MECANIQUE. CAS D'UNE ENTURE ET D'UNE EPROUVETTE AVEC TROU HABITE SOUMISES A UN PROFIL DE MISSION TYPE AVION DE COMBAT SUPERSONIQUE]
27 May 1986 52 p In FRENCH
(Rept-M1-538300; ETN-86-98430) Avail: NTIS HC A04/MF A01

The behavior of elementary technological elements such as bolts and perforated specimens under conditions equivalent to those of a combat aircraft are studied in order to evaluate the design parameters of carbon epoxy composite materials. The effects of simultaneous stress, temperature, and humidity variations were studied through 2500 cycles. It is shown that the bolted joint loses 30% of its strength, which is of the same order as the strength loss observed under static equivalent aging conditions. A hypothesis of relaxation of the composite material under the stress introduced by the bolts is presented. ESA

N87-14445# Centre Technique des Industries Mecaniques, Nantes (France).
ANALYSIS OF ABRASION AND CORROSION BEHAVIOR OF SCREWS AND CYLINDERS IN THERMOPLASTIC TRANSFORMATION MACHINES Final Report [ANALYSE DU COMPORTEMENT A LA CORROSION ET A L'ABRASION DE VIS ET FOURNEAUX DE MACHINES DE TRANSFORMATION DE MATIERES THERMOPLASTIQUES]
C. Bord, M. Brierre, A. Grospierre, and C. Relandeau 23 Sep. 1985 106 p In FRENCH
(CETIM-12-B-162; ETN-86-98451) Avail: NTIS HC A06/MF A01

The durability of screw and cylinder of thermoplastic machines processing glass reinforced resins such as polyamides at temperatures of the order of 300C is studied. The behavior of protective coatings including metallic coatings such as treated superalloys, ceramic oxides such as Al2O3, Z2O2, TiO2, carbides, nitrides and composite solutions was tested. The results show that TiN deposits obtained by cathode spraying are the most promising. ESA

N87-14446# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.
PRODUCTION OF ALUMINUM-SILICON CARBIDE COMPOSITES Thesis [PRODUKTIE VAN ALUMINIUM-SILICIUMCARBIDE COMPOSIETEN]
Leo J. Rodenburg May 1986 60 p In DUTCH
(ETN-86-98696) Avail: NTIS HC A04/MF A01

An apparatus which allows the production of particulate aluminum composites via the liquid phase was developed. The particles are added to a partially solidified and strongly stirred aluminum alloy, after which the composite material is again melted and poured. Composites were made from an Al-Si7 alloy with up to 3% Mg, and 5 weight % SiC-particles of 20, 88, or 100 microns. A structural analysis with microscopes shows that the addition of Mg improves the yield strength, tensile strength, and hardness of Al-Si7; elongation is reduced. Magnesium also improves the reception and distribution of SiC particles. The addition of particles increases the hardness and reduces the strain as compared to the pure alloys. ESA

N87-14447# Service Techniques des Programmes Aeronautiques, Paris (France). Section Materiaux.
INFORMATION NOTICE ABOUT THE REPAIR OF COMPOSITE STRUCTURES [NOTE D'INFORMATION SUR LA REPARATION DES STRUCTURES EN COMPOSITES]
M. Jacquelin 11 Sep. 1985 31 p In FRENCH
(STPA-42744; ETN-87-98580) Avail: NTIS HC A03/MF A01

The state of the art of composites repairing for military or private aircraft users is reviewed. The need for test laboratories with nondestructive test equipment, adequate personnel, and specific repairing materials is emphasized. ESA

N87-14448# Centre d'Essais Aeronautique Toulouse (France). Lab. d'Etudes de Materiaux non Metalliques.
ELEMENTARY CHARACTERIZATION OF THE AS4/2220.3 HERCULES PREPREG Final Test Report [CARACTERISATION ELEMENTAIRE DU PREIMPREGNE AS4/2220.3 D'HERCULES INC.]
11 Jun. 1986 51 p In FRENCH
(CEAT-M4-475-000; ETN-87-98583) Avail: NTIS HC A04/MF A01

The properties of preimpregnated carbon-epoxy were measured in order to evaluate its utilization for aircraft composite structural elements. It is shown that in spite of advanced gelification it does not evolve after 1 month storage. Mechanical measurements reveal a rather low and temperature sensitive interlayer shear resistance (55 MPa at 120 C). ESA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N87-14449# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

APPLICATION OF AN ATOMIC OXYGEN BEAM FACILITY TO THE INVESTIGATION OF SHUTTLE GLOW CHEMISTRY

G. S. Arnold and Daniel R. Peplinski 31 Oct. 1986 27 p (ATR-85(8367)-1) Avail: NTIS HC A03/MF A01

A facility for investigating the interactions of energetic atomic oxygen with solids is described. The facility is comprised of a four-chambered, differentially pumped molecular beam apparatus that can be equipped with one of a variety of sources of atomic oxygen. The primary source is a dc arc-heated supersonic nozzle source that produces a flux of atomic oxygen in excess of 10 to the 15th power/sq cm/sec at the target, at a velocity of 3.5 km/sec. Results of applications of this facility to the study of the reactions of atomic oxygen with carbon and polyimide films are briefly reviewed and compared to data obtained on various flights of the space shuttle. The possible application of this facility to the investigation of chemical reactions that might contribute to atmosphere-induced vehicle glow is discussed briefly. Author

N87-14450# Kernforschungsanlage, Juelich (West Germany).

CONTRIBUTIONS TO THE POST CSI-SYMPOSIUM OF THE 24TH COLLOQUIUM SPECTROSCOPICUM INTERNATIONALE ON THE ANALYSIS OF MATERIALS (METALS, CERAMICS, MINERALS) USING SPECTROSCOPIC METHODS

J. Rottmann, comp. Jan. 1986 160 p Partly in ENGLISH and GERMAN Symposium held in Juelich, West Germany, 23-24 Sep. 1985

(JUEL-Conf-55; ISSN-0344-5798; ETN-86-98268) Avail: NTIS HC A08/MF A01

Spectroscopic analysis of ferrous materials; spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications; high temperature mass spectrometry spectrochemical trace element determinations in geological materials; pressure decomposition of ores, slags, and oxidic materials; a stabilized dc plasma and spectrochemical analysis system; analysis of a phosphate standard; trace element analysis of coal; structural features of corundum color varieties; and thermal extraction of krypton in aluminum were discussed. For individual titles, see N87-14451 through N87-14462.

N87-14451# Hoesch Stahl A.G., Dortmund (West Germany).

ANALYSIS OF FERROUS MATERIALS

Knut D. Ohls *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 2-14 (For primary document see N87-14450 06-25)

Avail: NTIS HC A08/MF A01

The development of the methods used in iron and steel laboratories is described. The change of laboratory organization for economic reasons due to changes in techniques of conventional analysis, new methods for routine determinations, demands of research, and environmental method equipment is discussed. Economic imperatives lead to analytical problems which have to be solved by application of techniques like automated sample preparation and detection systems. Mass spectrometry combined with different sources responds to these demands. ESA

N87-14452# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.

SPECTROCHEMICAL ANALYSIS OF CORE MATERIALS FOR ADVANCED HIGH TEMPERATURE REACTORS WITH PROCESS HEAT APPLICATIONS

H. Nickel and M. Mazurkiewicz *In its* Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 15-29 (For primary document see N87-14450 06-25)

Avail: NTIS HC A08/MF A01

Spectroscopic methods for the analysis of graphitic and ceramic materials for the determination of trace elements, and localized analysis are described. Purity determinations, and determining local concentrations of impurity elements in irradiated graphite, especially in conjunction with graphite corrosion, are addressed. Investigation of irradiated graphites with different corrosion rates confirms the enrichment of elements on the corroded surface. Inhomogeneity in coarse-grained ceramic materials was investigated. Laser localized analysis allows the determination of element homogeneity in the fine and coarse grained regions of ceramics, to correlate mechanical strengths with concentration of various elements at the grain boundaries. Tests using inductively coupled plasmas for the direct analysis of powder specimens show that for each matrix material special thermochemical additives must be developed. ESA

N87-14453# Kernforschungsanlage, Juelich (West Germany). Inst. of Applied Physical Chemistry.

POTENTIAL OF HIGH TEMPERATURE MASS SPECTROMETRY FOR THE ANALYSIS OF MATERIALS

K. Hilpert *In its* Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 30-43 (For primary document see N87-14450 06-25)

Avail: NTIS HC A08/MF A01

High temperature mass spectrometry with a Knudsen cell is described. Instruments using magnetic type sector field, and quadrupole mass spectrometers are shown. Applications of the method include identification of the gaseous molecules forming the equilibrium vapor in the Knudsen cell; and determination of their partial pressures in the range from 0.0000001 to 10 Pa and up to temperatures of 2800 K, and computation of thermodynamic functions from the measured partial pressures and their temperature dependences, for example enthalpies and entropies of vaporization, of dissociation, and of formation. ESA

N87-14454# Kernforschungsanlage, Juelich (West Germany). Zentralababteilung fuer Chemische Analysen.

ADVANCED CHEMICAL ANALYSIS SERVICE AT THE NUCLEAR RESEARCH CENTER, JUELICH, WEST GERMANY

H. E. Beske and B. Sansoni *In its* Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 44-50 (For primary document see N87-14450 06-25)

Avail: NTIS HC A08/MF A01

Mass spectrometrical methods; radio analytical methods; X-ray analysis methods; atomic spectrometry and classical chemical methods; molecular spectrometry with infrared spectrometry; and reactor survey methods for materials investigations are summarized. ESA

N87-14455# Eotvos Lorand Univ., Budapest (Hungary). Inst. fuer Anorganische und Analytische Chemie.

OPTIMIZATION OF SPECTROGRAPHIC TRACE ANALYSIS [OPTIMIERUNG DER SPEKTROGRAPHISCHEN SPURENANALYSE]

K. Florian and K. Zimmer *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 51-67 In GERMAN (For primary document see N87-14450 06-25)

Avail: NTIS HC A08/MF A01

The parameters of spectrographic analysis were optimized by spectrochemical additives. Their effects on temperature evaporation of the trace elements, and accuracy are summarized. The

accuracy of the analysis is characterized by different terms which show that the spectrochemical additives improve the analytical calibration and justify the method. For an optimization of the spectrographic analysis for materials with a matrix concentration of alkali highly effective halogen additives should be used. ESA

N87-14456# Komensky Univ., Bratislava (Czechoslovakia). Inst. of Geology.
STUDY OF THE ACCURACY OF SPECTROCHEMICAL TRACE ELEMENT DETERMINATIONS IN GEOLOGICAL MATERIALS
Eduard Plsko *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Method Jan. 1986 p 68-74 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

Direct current arc excitation spectral analysis of geological samples with direct evaporation of the solid samples mixed with appropriate additives from the crater of samples bearing electrode is described. The blocking of spectral lines was transformed in the intensities by the use of emulsion calibration curves constructed for different wavelength regions from the data of preliminary curves. If necessary, background correction was performed. For the calibration, synthetic samples simulating the matrix composition were used. Results show that the spectrochemical analysis of trace elements in geological materials using dc arc excitation furnishes reliable results. ESA

N87-14457# Max-Planck-Inst. fuer Festkoerperforschung, Stuttgart (West Germany).
PRESSURE DECOMPOSITION OF ORES, SLAGS AND OXIDIC MATERIALS FOR INDUCTIVELY COUPLED PLASMA (ICP) AND ATOMIC ABSORPTION SPECTROSCOPY (AAS) ANALYSIS
O. Buresch and H. G. vonSchnering *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Metods Jan. 1986 p 75-80 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

A Teflon liner for steel pressure vessels used in oxidizing decomposition for inductively coupled plasma analysis of metal phosphides was developed. The seal remains intact even after extensive usage at temperatures up to 200 C. A decomposition procedure which can supply a solution with one test sample was developed. ESA

N87-14458# National Chemical Lab. for Industry, Tokyo (Japan). Tsukuba Research Center.
A STABILIZED dc PLASMA AND AN ADVANCED SPECTROCHEMICAL ANALYSIS SYSTEM
R. Ishida *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 81-87 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

A dc plasma light source and a system for introducing a large sample into the measuring area were developed. Using a computer controlled image pick-up tube photometric system, a highly sensitive observation becomes possible. Line spectra of boron are presented. ESA

N87-14459# Nuclear Materials Corp., Cairo (Egypt).
ANALYSES OF THE PHOSPHATE STANDARD OF THE EGYPTIAN NUCLEAR MATERIALS CORPORATION (PHOSPHATE 1)
Monir M. Aly *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 88-100 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

A whole rock phosphorite was prepared for a series of rock standards. Statistical analysis for silica, phosphorus, calcium, iron, and strontium in fractions of the rock show the homogeneity of the sample. Conventional methods, as well as rapid analysis, inductively coupled plasma spectrometry, X-ray fluorescence activation analysis, infrared spectroscopy. Atomic absorption and laser induced fluorescence techniques were used to characterize the sample. ESA

N87-14460# Cape Town Univ. (South Africa). Dept. of Geochemistry.
A COMPARISON OF TRACE ELEMENT ANALYSIS OF WHOLE COAL BY INAA AND XRFS
J. P. Willis *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 101-117 Sponsored by Cape Town Univ., CSIR Foundation for Research Development, and Max-Planck Inst. fuer Chemie (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

Trace element data obtained by instrumental neutron activation analysis (INAA) and X-ray fluorescence spectroscopy (XRFS) on 14 coals and 5 international coal standards are compared. The most serious problems associated with the analytical procedures are calibration errors using INAA; lack of infinite thickness, errors in mass absorption coefficient determination, and errors caused by mineralogical effects for U, Cr and As determination by XRFS when using silicate standards. For other trace elements agreement between data obtained by XRFS and INAA is within analytical error. ESA

N87-14461# Kernforschungsanlage, Juelich (West Germany).
STRUCTURAL FEATURES OF CORUNDUM COLOR VARIETIES BY SPECTROSCOPIC METHODS
L. A. Guirguis and A. H. Rasmy *In its* Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 118-135 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

Analysis of major, minor, and trace element contents, IR spectral investigation, gamma irradiation, thermal treatment, and microscopic investigation were used to study Egyptian corundum colors. The purple color is attributed to the presence of Cr(3+) substituted for Al(3+) in the crystal lattice. A charge transfer between Fe(2+) - Ti(4+) and Fe(3+) + Ti(3+) could be the cause of the blue color. The difference in the distribution and amount of the ilmenite and hematite found as intergrowths within the carrying crystals could be the reason for the gray coloration, while the brown coloration could be due to the presence of red bars of iron oxides through physical optics effect. The IR spectrograms reveal the presence of different sites of structural water in the different colored corundum varities. Thermogravimetric and X-ray diffraction analyses confirm that this is due to minor amount of diaspore. ESA

N87-14462# Tokyo Science Univ. (Japan).
THERMAL EXTRACTION OF KRYPTON IN ALUMINUM USING A MASS SPECTROMETER
K. Takaishi, T. Kikuchi, K. Furuya, I. Hashimoto, H. Yamaguchi, E. Yagi, and M. Iwaki *In* Kernforschungsanlage Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods Jan. 1986 p 136-152 (For primary document see N87-14450 06-25)
Avail: NTIS HC A08/MF A01

The behavior of Kr bubbles in Al was studied using a thermal extraction mass spectrometer and an electron microscope attached to an energy dispersive X-ray spectrometer. The diffusion coefficient of Kr in Al was measured and estimated to be 10 to the minus 15th to minus 14th power sqcm/sec in the temperature range of 713 to 813 K. The activation energy for diffusion of Kr bubbles is 1.4 eV. ESA

N87-14463*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF THE RAW MATERIAL COMPOSITION OF FABRICS ON THE LIMITING OXYGEN INDEX (LOI)
S. Jeler and B. Ceric Oct. 1986 15 p Transl. into ENGLISH from Tekstil (Yugoslavia) v. 29, no. 3, 1980 p 151-156 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Technical Higher School, Maribor, Yugoslavia
(Contract NASw-4005)
(NASA-TM-88483; NAS 1.15:88483) Avail: NTIS HC A02/MF A01 CSCL 99F

The raw material composition of fabrics is one of the most important factors for LOI value. LOI value was determined in samples of varying composition composed of cellulose, protein, and synthetic fibers and their mixtures, based on ASTM D 2863-76. Cellulose fibers and their mixtures exhibited the lowest value, while synthetic fibers had the highest LOI value. Author

N87-14464*# National Aeronautics and Space Administration, Washington, D.C.
ELECTROCHEMICAL BEHAVIOR OF A TITANIUM ELECTRODE IN HYDRAZINE SOLUTIONS
A. K. Levchenko, G. A. Kuznetsov, V. B. Bogdanovich, and A. K. Korolev Dec. 1986 8 p Transl. into ENGLISH from Nekotoryye Voprosy Sovremennogo Elektrokhimiya Kineticka (USSR), v. 1, p 107-113 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88538; NAS 1.15:88538) Avail: NTIS HC A02/MF A01 CSCL 99F

The kinetics of the establishment of the oxidation-reduction potential of a titanium electrode upon contact with hydrazine was studied in different media: H2SO4, NaOH, and Na2SO4. It was found that the nature of the potential shift depends little on the medium. The initial potential determines the rate of potential displacement upon contact with hydrazine, which is explained by the different condition of the electrode's surface. Author

N87-14465*# National Aeronautics and Space Administration, Washington, D.C.
OXYGEN INDEX: AN APPROXIMATE VALUE FOR THE EVALUATION OF COMBUSTION CHARACTERISTICS
Isolde Zartmann, Dieter Reinwardt, and Albrecht Franke Sep. 1986 11 p Transl. into ENGLISH from Plaste und Kautschuk (East Germany), v. 27, no. 11, 1980 p 623-625 Transl. by Scitran, Inc., Santa Barbara, Calif. Original document prepared by Ministry for the Chemical Industry, Dept. for Protection Against Fire and Sea Damage, Karl-Marx-Stadt, East Germany
(Contract NASw-4004)
(NASA-TM-88492; NAS 1.15:88492) Avail: NTIS HC A02/MF A01 CSCL 99F

The oxygen index has gained international recognition for the determination of combustion characteristics of plastic material. The amounts of oxygen and nitrogen were more accurately determined for existing test equipment in order to specify the oxygen index as precisely and as reproducible as possible. Parameters are outlined such as the size of the ignition flame, ignition of test pieces, test piece sizes and test temperature. The minimum oxygen index was determined by the dimension and duration of the fire. The results are sufficiently accurate for factory operating conditions and are also reproducible. Author

N87-14466*# Eloret Corp., Sunnyvale, Calif.
STRUCTURAL CHARACTERIZATION AND GAS REACTIONS OF SMALL METAL PARTICLES BY HIGH RESOLUTION IN-SITU TEM (TRANSMISSION ELECTRON MICROSCOPY) AND TED (TRANSMISSION ELECTRON DIFFRACTION) Periodic Technical Report, 1 Jan. - 31 Dec. 1986
Klaus Heinemann 2 Jan. 1987 36 p
(Contract NCC2-283)
(NASA-CR-180020; NAS 1.26:180020) Avail: NTIS HC A03/MF A01 CSCL 99F

The detection and size analysis of small metal particles supported on amorphous substrates becomes increasingly difficult when the particle size approaches that of the phase contrast background structures of the support. An approach of digital image analysis, involving Fourier transformation of the original image, filtering, and image reconstruction was studied with respect to the likelihood of unambiguously detecting particles of less than 1 nm diameter on amorphous substrates from a single electron micrograph. B.G.

N87-14467# Ballistic Research Labs., Aberdeen Proving Ground, Md.
KINETIC MECHANISMS FOR PREMIXED, LAMINAR, STEADY STATE HYDROGEN-NITROUS OXIDE FLAMES
Terence P. Coffee May 1986 31 p
(AD-A169404; BRL-TR-2729) Avail: NTIS HC A03/MF A01 CSCL 21/2

The kinetics governing premixed, laminar, one-dimensional hydrogen/nitrous oxide flames is discussed. The long range goal is to understand the kinetics governing propellant decomposition, where nitrogen chemistry is important. Hydrogen/nitrous oxide flames are the simplest case of a flame controlled by nitrogen chemistry. A model has been developed for premixed, laminar, one-dimensional hydrogen/nitrous oxide flames. Results have been compared with a range of experimental data. The present model roughly reproduces the data, but inaccuracies still exist. Sensitivity and screening analyses have been used to indicate the additional experimental data needed to improve the model. GRA

N87-14468# United Technologies Corp., Farmington, Conn.
ELECTROCHEMICAL REDUCTION OF CARBON DIOXIDE Final Report
Anthony B. LaConti, Trent M. Molter, and John A. Zagaja May 1986 30 p
(Contract N00014-82-C-2182)
(AD-A169630) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electrochemical reduction of carbon dioxide and related organic species to form concentrated liquid/gaseous products in laboratory scale hardware is well known. A high pressure SPE electrolysis cell capable of reducing carbon dioxide streams to form pure, concentrated alcohols, carboxylic acids, and other hydrocarbons has been developed. The process is unique in that the byproducts of reaction include oxygen and, under some test conditions water. In addition, a relatively simple test system was designed and constructed permitting both batch and semibatch type electrochemical reduction studies. In this study, cathode materials were developed which: (1) had a characteristic high hydrogen overvoltage, and (2) possessed the intrinsic affinity for electrochemical reduction of the carbon dioxide species. In addition, suitable anode electrocatalyst materials were identified. Studies involving the electrochemical reduction of carbon dioxide required the ability to identify and quantify reaction products obtained during cell evaluation. Gas chromatographic techniques were developed along with the establishment of ion chromotographic methods permitting the analysis of organic reaction products. GRA

N87-14469# Dayton Univ., Ohio.
THE 7TH SYMPOSIUM ON APPLIED SURFACE ANALYSIS Final Report, 18 Mar. 1985 - 30 Mar. 1986
John T. Grant Jul. 1986 55 p Symposium held at College Park, Md., 15-17 May 1985
(Contract N00014-85-C-0118)
(AD-A169640; UDR-TR-86-60) Avail: NTIS HC A04/MF A01 CSCL 07/4

Areas receiving special attention at this symposium were: chemical bonding and reactions at metal-semiconductor interfaces; surface analysis and the tribological processes of ion implanted materials; microbeam analysis; and laser ionization of sputtered neutrals. Other topics discussed included adsorption, adhesion, corrosion, wear, and thin films. The proceedings of the symposium have been published in a special issue of the journal: Applied Surface Science. GRA

N87-14470# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
LOW TEMPERATURE SILICON OXIDATION STUDIES
E. A. Lewis, E. Kobeda, and E. A. Irene 20 Jun. 1986 11 p
(Contract N00014-83-K-0571)
(AD-A169699; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

Several models have been proposed to explain the role of stress on low temperature silicon oxidation kinetics but the lack of experimental data has precluded an analysis of these models. The results of experimental studies independently measuring the reaction kinetics and intrinsic stress as a function of orientation and oxidation temperature are presented. The proposed stress models are evaluated in terms of these results. It is concluded that the existing models do not explain all aspects of the data. GRA

N87-14471# State Univ. of New York, Buffalo. Dept. of Chemistry.
THEORY OF SPECTROSCOPY AND DYNAMICS IN LASER-IRRADIATED ADSPECIES-SURFACE SYSTEMS
Thomas F. George, Daniel Jelski, Xi-Yi Huang, and A. C. Beri Jul. 1986 26 p
(Contract N00014-86-K-0043)
(AD-A170148; UBUFFALO/DC/86/TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

Recent progress in the theory of spectroscopy and in dynamics laser irradiated adspecies surface systems is discussed. This article is divided into three main sections. First, a first principles approach for describing vibrational excitation and relaxation of a laser excited adatom is presented. A tractable approximation is introduced in order to numerically deal with the long time behavior of the dynamics. In the next section, surface dressed optial Bloch equations are solved for the resonance fluorescence spectrum of a laser driven two level atom near a flat metal surface and also near a rough metal surface modeled by a hemispheroid on a perfectly conducting plane. In the final section, the problem of laser induced period chemical vapor deposition is addressed, and a theoretical analysis of selected aspects of an experiment on the deposition of cadmium onto a silica surface is carried out, where the cadmium is produced by laser-induced dissociation of dimethyl cadmium gas above the surface. GRA

N87-14472# Naval Academy, Annapolis, Md.
A COMPUTER SIMULATION OF DETONATION WITHIN AN ENERGETIC MOLECULAR CRYSTAL Final Report, 1985 - 1986
Alan D. Boyd 11 Jul. 1986 86 p
(AD-A171662; USNA-TSPR-134) Avail: NTIS HC A05/MF A01 CSCL 09/4

The study of detonation has been based upon hydrodynamic theory. This view of detonation completely ignores the actual chemistry of the explosive reaction. Therefore, the dynamics of detonation on a molecular level remain unknown. The purpose of this project is to use a computer to investigate the propagation of detonation through a crystal. Research in this area is hindered by the fact that monitoring instruments are destroyed in actual detonations. Computer simulations avoid this problem because there is no physical explosion. The actual detonation is extremely rapid; collection of data at designated conditions or times can not be guaranteed. The computer does not have this problem since it can be programmed to display the data at any desired condition or time. A nonhomogeneous crystal of diatomic molecules was monitored to discover the atomic interactions during detonation. A Lennard-Jones potential equation was used to represent the exothermic reaction between diatomic hydrogen and chlorine molecules. This is the first project to use the natural formation of stable reaction products to achieve exothermicity.cts to achieve exothermicity. GRA

N87-14473# Research Triangle Inst., Research Triangle Park, N.C.
STUDY OF MEAN FREE PATH EFFECTS ON GROWTH OF ULTRAFINE METALLIC AEROSOLS Annual Report, 1 May 1985 - 30 Jun. 1986
Philip A. Lawless 31 Jul. 1986 32 p
(Contract F49620-84-C-0017)
(AD-A173068; AFOSR-86-0943TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The dynamics of aerosol formation in gaseous atmospheres ranging from conditions at the Earth's surface to those in the extreme upper atmosphere are being investigated. The research involves theoretical and experimental determination of the behavior of ultrafine aerosol particles at high concentrations. The normal diffusion-limited coagulation and growth of aerosols is expected to be strongly modified as the particle diameter and the interparticle separation approach the mean free path of the gas molecules. Under reduced pressure conditions, the metallic aerosol produced is very complex in shape, and the use of fractal descriptions was investigated. The report details the kind of fractal analysis used. It shows that the particles have fractal characteristics which describe stages of growth and that the pressure under which the particles are grown does influence the growth structure. At very low pressure, the particles formed by the exploding wire generator appear to evaporate before they can solidify. GRA

N87-14474# Sandia National Labs., Albuquerque, N. Mex.
SHOCK-INDUCED SOLID-STATE CHEMICAL REACTIVITY STUDIES USING TIME-RESOLVED RADIATION PYROMETRY
M. B. Boslough 1986 19 p Presented at the Hypervelocity Impact Symposium, San Antonio, Tex., 21 Oct. 1986
(Contract DE-AC04-76DP-00789)
(DE86-013576; SAND-86-1614C; CONF-861091-3) Avail: NTIS HC A02/MF A01

Time-resolved radiation pyrometry has been used to study materials which undergo solid-state chemical reactions due to shock loading. Shock-induced chemical reactivity in solids is fundamentally different than that in high explosives and other energetic materials because if no volatiles are present the reaction products end up in the condensed, rather than the vapor, state. Bulk property changes accompanying the solid-state reactions may therefore be too small to be observable with wave profile or shock-velocity measurements. However, some solid-state reactions, such as that between metallic nickel and aluminum, are exothermic enough to give rise to a measurable increase in temperature, so pyrometry can be used to detect the reactions. Unfortunately, these measurements are complicated by the large temperature increases generated by other sources. Possible mechanisms for generation of these high temperatures, and their effect on the chemical reaction, are suggested. DOE

N87-14475# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INELASTIC SCATTERING EXPERIMENTS FOR THE INVESTIGATION OF THE ROTATIONAL EXCITATIONAL OF O2, N2, CO, AND NO MOLECULES BY Ar AND Ne Thesis [INELASTISCHE STREUEXPERIMENTE ZUR UNTERSUCHUNG DER ROTATION-SANREGUNG VON O2-, N2-, CO- UND NO-MOLEKUELEN DURCH AR UND NE]
G. R. Kraft Feb. 1986 215 p In GERMAN
(MPIS-2/1986; ISSN-0436-1199; ETN-86-98224) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 42

The anisotropy of the interaction of Ne and Ar-atoms with N2, O2, CO, and NO was investigated in a scattering experiment with two crossed molecular beams. The measured angular distribution of the system Ne-Ar satisfactorily agrees with calculated scattering cross sections, while deviations from theoretical cross sections are found for Ar-Ar ain the domain of fast oscillations. For the systems Ne-O2, H2, NO, Ar-O2, N2, CO, and NO fast oscillations were resolved. Time of flight measurements for the systems Ar-O2, N2, CO, No, and Ne-O2 show in-plane rotational rainbow structures which allow a preliminary estimation of the anisotropy of the potentials. The investigation of atom-diatom systems with particles of comparable mass represent an important step towards the understanding of diatom-diatom systems. ESA

N87-14476# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.
MICROWAVE MEASUREMENT OF THE COMBUSTION VELOCITY OF SOLID PROPELLANTS (4) [MESURE PAR MICROONDES DE LA VITESSE DE COMBUSTION DES PROPERGOLS (4)]
Paul Kuentzmann and Michel Prevost 27 Feb. 1986 58 p In FRENCH
(Contract DRET-84-34-001)
(ONERA-RTS-11/3173-EY; ETN-86-98427) Avail: NTIS HC A04/MF A01

A microwave measurement system for combustion measurements was studied, including the shape of the microwave signals, numerical data treatment procedures, and computerized simulations. An empirical method to correct the form of the signals is described. In the case of unsteady combustion the measurements above 60 Hz are abnormally high, while at lower frequencies the results are satisfactory. ESA

N87-14477# Technische Hogeschool, Delft (Netherlands). Tussenafdeing der Metaalkunde.
ISOTHERMAL RESISTIVITY MEASUREMENTS ON Fe40Ni40B20 AND Pd80Si20 Thesis [ISOTHERME WEERSTANDSMETINGEN AAN FLCE40NLCI40B20 EN PLCD80SLCI20]
Esther Kokmeijer Jun. 1986 72 p In DUTCH; ENGLISH summary
(ETN-87-98697) Avail: NTIS HC A04/MF A01

Resistivity measurements were performed on Fe40 Ni40 B20 and Pd80 Si20 in order to improve the understanding of structural relaxation in amorphous metals. A model describing structural relaxation as a combination of chemical short range ordering (CSRO) and topological short range ordering (TSRO) is presented. The measurements of the change of resistivity of Fe40 Ni40 B20 at the annealing temperature and in liquid nitrogen show that Matthiessen's rule is not valid for amorphous metals, and that three effects are necessary to describe structural relaxation: CSRO, TSRO, and a third (irreversible) effect which presumably has a topological character. The isothermal resistivity measurements on amorphous Pd80 Si20 show that the structure of the material is not homogeneous, and that it is difficult to control the melt spinning process. ESA

N87-14478# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.
MEASUREMENT OF PRESSURE FLUCTUATIONS ON THE WALL OF A TURBULENT COMBUSTION FURNACE Final Report [MESURE DES FLUCTUATIONS DE PRESSION A LA PAROI D'UN FOYER A COMBUSTION TURBULENTE]
Pierre Moreau 24 Dec. 1985 48 p In FRENCH
(Contract DRET-83-34-134)
(ONERA-RTS-47/7104-EY; ETN-87-98578) Avail: NTIS HC A03/MF A01

Data on a furnace were obtained to allow an acoustic analysis. The experimental set-up includes a furnace measuring 100 x 100 x 1328 mm, a main air-methane injector, and a secondary hot gas flow to initiate and to stabilize the combustion. The main flow is characterized by 55 m/sec velocity and a fuel to air ratio adjustable from 0 to 1.2. The results show the presence of almost plane waves. Low frequency fluctuations are found to be stronger in combustion conditions. Other instabilities are also discussed. ESA

N87-14479# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF THE VELOCITY AND TEMPERATURE OF IGNITION GAS AND THE ROLE OF THE PARTICLES IN THE IGNITION MECHANISM [BEITRAG ZUR GESCHWINDIGKEITS- UND TEMPERATUREMESSTECHNIK AN ANZUENDSCHWADEN SOWIE ZUR PARTIKELZUENDUNG]
H. Mach 31 Dec. 1986 51 p In GERMAN Presented at the Conference CCG-Lehrgang: An- und Abrandvorgaenge von Treibladungspulvern, Weil am Rhein, West Germany, 2-6 Dec. 1985
(ISL-CO-241/85; ETN-87-98797) Avail: NTIS HC A04/MF A01

Measuring techniques for the velocity and temperature of the ignition gases for propellant charge powders are discussed. The ignition clouds consist of a gaseous component and a component in the form of particles. For the measurement of the cloud velocity, the propagation of the flame front, the streak method, the two-focus method, laser Doppler anemometry, the correlation method, and the laser Doppler velocimeter method are discussed. For the measurement of the cloud temperature, thermoelectric and spectroscopic methods are discussed. It is shown that these measuring methods are primarily based on the particles present in the flow. Origin and detection of the particles, their size distribution and their concentration, and the particle ignition are treated. The mass and energy flow in ignition clouds is discussed. ESA

N87-14480# Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF THE VELOCITY AND TEMPERATURE OF IGNITION GAS JETS IN A BED OF CONFINED INERT POWDER [GESCHWINDIGKEITS- UND TEMPERATURMESSUNGEN AN ANZUENDSCHWADEN IM VERDAEMMTEN INERTPULVERBETT]
H. Mach 13 Nov. 1985 18 p In GERMAN Presented at the 11th Symposium on Innenballistische Leistungssteigerung von Rohrwaffen, Swisttal-Heimrzheim, West Germany, 11-13 Nov. 1985
(ISL-CO-245/85; ETN-87-98799) Avail: NTIS HC A02/MF A01

The flow velocity and the temperature of the combustion gases of four types of propellant ignition charges were measured at two different depths after their penetration in a measurement chamber filled with inert granules. It is shown that the combustion products which are rich in particles undergo the strongest deceleration, and the weakest cooling during the penetration in the granules bed. The results illustrate the nature of the penetration of combustion products and the energy transfer to the granules bed. ESA

N87-14333# Stuttgart Univ. (West Germany).
ELEMENTARY-REACTION AND FLOW-MECHANICAL PROBLEMS IN AIRCRAFT AND SPACECRAFT DRIVES [ELEMENTARREAKTION UND STROEMUNGSMECHANISCHE PROBLEME DER LUFT- UND RAUMFAHRTANTRIEBE]
Hirst H. Grotheer and Ulrich Meier *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 25-56 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14334# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
MASS SPECTROMETRIC CONCENTRATION MEASUREMENTS IN SUPERSONIC FLOWS WITH CHEMICAL REACTIONS [MASSENSPEKTROMETRISCHE KONZENTRATIONSMESSUNGEN IN UEBERSCHALISTROEMUNGEN MIT CHEMISCHEN REAKTIONEN]
Arnold Frohn *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 57-76 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14336# Stuttgart Univ. (West Germany).
FLAME DIAGNOSIS USING COHERENT ANTI-STOKES RAMAN SCATTERING (CARS) [FLAMMENDIAGNOSE MIT CARS (COHERENT ANTISTOKES RAMAN SCATTERING)]
Winfried Stricker *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 127-152 In GERMAN Previously announced as N83-34829 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14338# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.

COMBUSTION PROCESS OF HYDROGEN-AIR MIXTURES UNDER TECHNICAL CONDITIONS [VERBRENNUNGSABLAUF VON WASSERSTOFF-LUFT-GEMISCHEN UNTER TECHNISCHEN BEDINGUNGEN]
Johannes Algermissen and Peter Kasal *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 163-199 In GERMAN (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N87-14481 Central Electricity Generating Board, London (England). Translation Section/Overseas Service.
THE INFLUENCE OF CREEP ON THE PRECIPITATE STRUCTURE UNDER CONDITIONS OF LONG-TERM CREEP. PART 3: INVESTIGATION OF FERRITIC MODEL STEELS
Otto Schulze and Gerhard Sauthoff 1986 20 p Transl. into ENGLISH from Arch. Eisenhuettenwes. (West Germany), v. 54, no. 8, Aug. 1983 p 337-342
(BLL-CE-Trans-8252-(9022.09); AUD06066S03-13-WLC) Avail: Issuing Activity

The precipitation and aging behavior of a model steel with 4% Mo and 0.04% C at 600 C and of a model steel with 4% Mo, 0.3% V and 0.05% C at 700 C with and without concurrent creep deformation was studied. Precipitation sequences and equilibria between precipitate phases was included. The theoretical discussion of the possible effects of Parts 1 and 2 concluded that a noticeable effect on the behavior of a precipitated phase due to simultaneous creep deformation is only to be expected under special circumstances. In the case of the precipitation of only one phase, dislocation creep can accelerate the reduction in coherency on particle growth, which leads to an increase in the coarsening rate of the precipitate phase. This was the subject of an experiment on an Fe-Cu model alloy. It became evident that these effects can be ignored and that they are not even to be expected with ferritic steels under conditions of long term stress. E.R.

N87-14482* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NICKEL BASE COATING ALLOY Patent
Charles A. Barrett and Carl E. Lowell Issued 9 Sep. 1986 4 p Filed 23 Mar. 1983 Supersedes N83-24639 (21 - 14, p 2189)
(NASA-Case-LEW-13834-1; US-Patent-4,610,736;
US-Patent-Appl-SN-478131; US-Patent-Class-148-429;
US-Patent-Class-420-460) Avail: US Patent and Trademark Office CSCL 11F

Zirconium is added to a Ni-30 Al (beta) intermetallic alloy in the range of 0.05 w/o to 0.25 w/o. This addition is made during melting or by using metal powders. The addition of zirconium improves the cyclic oxidation resistance of the alloys at temperatures above 1100 C.
Official Gazette of the U.S. Patent and Trademark Office

N87-14483*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CYCLIC STRESS-STRAIN BEHAVIOR OF PWA 1480 AT 650 DEG C
T. P. Gabb and G. E. Welsch (Case Western Reserve Univ., Cleveland, Ohio) 1986 16 p Presented at the TMS-AIME Annual Meeting, New Orleans, La., 2-6 Mar. 1986 Previously announced as A86-45715
(NASA-TM-87311; E-3038; NAS 1.15:87311) Avail: NTIS HC A02/MF A01 CSCL 11F

The monotonic plastic flow behavior of several single crystal nickel-base, superalloys has been shown to vary significantly with crystallographic orientation. In the present study, the cyclic plastic flow response of one such alloy, PWA 1480, was examined at 650 deg C in air. Single crystal specimens aligned near several crystallographic directions were tested in fully reversed, total-strain-controlled low cycle fatigue tests at a frequency of 0.1 Hz. The cyclic stress-strain response and general cyclic hardening behavior was analyzed as a function of crystallographic orientation and inelastic strain range. Author

N87-14484# National Bureau of Standards, Gaithersburg, Md.
HIGH-TEMPERATURE CORROSION AND METHODS OF ITS CONTROL
A. V. Byalobzheskii and Y. N. Golovanov 1985 153 p Transl. into ENGLISH from the book "Vysokotemperaturnaya Korroziya i Metody Zaxhchity ot Nee" Moscow, USSR, 1973 Sponsored by NSF
(PB86-229663; TT-79-52020) Avail: NTIS HC A08/MF A01 CSCL 11F

The book presents the original investigations on high-temperature corrosion in air, molten metals, and fused salts (halides, cyanides, etc.). The following topics have been examined in the different sections of the book: theoretical aspects of the process of high-temperature oxidation of metals and semiconductors; laws of corrosion of titanium, zirconium, vanadium, tungsten and others by gases; corrosion of metals in melts; methods of production, properties and corrosion resistance of heat-resistant silicide, oxide and chromium coatings. It provides information on the methods of protecting structural materials from high-temperature corrosion. GRA

N87-14485# Defence Research Information Centre, Glasgow (Scotland).
RECENT PROGRESS IN THE FIELD OF CATHODIC PROTECTION
D. C. Harris Jan. 1986 14 p Transl. into ENGLISH from La Chmica e LIndustria, (Italy), v. 65, no. 3, 1983 p 169-173
(DRIC-T-7657; BLL-Trans-(3623.66)) Avail: NTIS HC A02/MF A01

Several applications of cathodic protection are described. The differences between onshore and offshore cathodic protection; recent advances in the cathodic protection of offshore structures; current size, variability, and distribution; mathematical models and methods of use in design; anodes made from titanium whose surface is activated by ruthenium or iridium oxides; and advances in the performance of sacrificial anodes are discussed. Author

N87-14486*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
A STUDY OF THE MICROSTRUCTURE OF A RAPIDLY SOLIDIFIED NICKEL-BASE SUPERALLOY MODIFIED WITH BORON M.S. Thesis. Final Contractor Report
James S. Speck Nov. 1986 87 p
(Grant NAG3-365)
(NASA-CR-179553; NAS 1.26:179553) Avail: NTIS HC A05/MF A01 CSCL 11F

The microstructures of melt-spun superalloy ribbons with variable boron levels have been studied by transmission electron microscopy. The base alloy was of approximate composition Ni-11% Cr-5%Mo-5%Al-4%Ti with boron levels of 0.06, 0.12, and 0.60 percent (all by weight). Thirty micron thick ribbons display an equiaxed chill zone near the wheel contact side which develops into primary dendrite arms in the ribbon center. Secondary dendrite arms are observed near the ribbon free surface. In the higher boron bearing alloys, boride precipitates are observed along grain boundaries. A concerted effort has been made to elucidate true grain shapes by the use of bright field/dark field microscopy. In the low boron alloy, grain shapes are often convex, and grain faces are flat. Boundary faces frequently have large curvature, and grain shapes form concave polygons in the higher boron level alloys. It is proposed that just after solidification, in all of the alloys studied, grain shapes were initially concave and boundaries were wavy. Boundary straightening is presumed to occur on cooling in the low boron alloy. Boundary migration is precluded in the higher boron alloys by fast precipitation of borides at internal interfaces. Author

N87-14487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF LASER GLAZING ON LIFE OF ZrO2 TBCs IN CYCLIC BURNER RIG TESTS
I. Zaplatynsky Aug. 1986 12 p
(NASA-TM-88821; E-3026; NAS 1.15:88821) Avail: NTIS HC A02/MF A01 CSCL 11F

The performance of laser glazed zirconia (containing 8 wt% Y2O3) TBC's was evaluated in burner rig cyclic oxidation tests at 1000 and 1050 C. It was found that the cycle duration has no effect on life of TBC's and that the increase in thickness of the glazed layer caused a slight reduction in life. Author

N87-14488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF Cr, Co, Al, Mo AND Ta ON A SERIES OF CAST NI-BASE SUPERALLOYS ON THE STABILITY OF AN ALUMINIDE COATING DURING CYCLIC OXIDATION IN MACH 0.3 BURNER RIG
Isidor Zaplatynsky and Charles A. Barrett Oct. 1986 27 p
(NASA-TM-88840; E-3007; NAS 1.15:88840) Avail: NTIS HC A03/MF A01 CSCL 11F

The influence of varying the content of Co, Cr, Mo, Ta, and Al in a series of cast Ni-based gamma/gamma'superalloys on the behavior of aluminide coatings was studied in burner rig cyclic oxidation tests at 1100 C. The alloys had nominally fixed levels of Ti, W, Cb, Zr, C, and B. The alloy compositions were based on a full 2(sup 5)-fractional statistical design supplemented by 10 star point alloys and a center point alloy. This full central composite design of 43 alloys plus two additional alloys with extreme Al levels allowed a complete second degree estimating equation to be derived from the 5-compositional variables. The weight change/time data for the coated samples fitted well to the paralinear oxidation model and enabled a modified oxidation attack parameter, K'(sub a) to be derived to rank the alloys and log K' (sub a) to be used as the dependent variable in the estimating equation to determine the oxidation resistance of the coating as a function of the underlying alloy content. The most protective aluminide coatings are associated with the highest possible base ally contents of CR and Al and at a 4 percent Ta level. The Mo and Co effects interact but at fixed levels of 0, 5, or 10% Co. A 4% Mo level is optimum. Author

N87-14489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESTIMATION OF HIGH TEMPERATURE LOW CYCLE FATIGUE ON THE BASIS OF INELASTIC STRAIN AND STRAINRATE
A. Berkovits Sep. 1986 13 p
(NASA-TM-88841; E-3168; NAS 1.15:88841) Avail: NTIS HC A02/MF A01 CSCL 11F

Fatigue life at elevated temperature can be predicted by introducing parametric values obtained from monotonic constitutive behavior into the Universal-Slopes Equation. For directionally solidified MAR-M200+HF at 975 C, these parameters are the maximum stress achievable under entirely plastic (time-independent) and purely creep (time-dependent) conditions and the corresponding inelastic strains, as well as the elastic modulus. For materials which exhibit plasticity/creep interaction, two more pairs of monotonic parameters must be evaluated for fatigue life prediction. This life-prediction method based on the Universal-Slopes Equation, resulted from a constitutive model characterizing monotonic and cyclic data as inelastic strainrate as a function of inelastic strain. Characterizing monotonic data is this way, permitted distinction between different material responses such as strain-hardening, strain-softening, and dynamic recovery effects. Understanding and defining the region of influence of each of these effects facilitated formulation of the constitutive model in relation to the mechanical and microstructural processes occurring in the material under cyclic loading. Author

N87-14490# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
COMPARISON BETWEEN ELECTRODEPOSITED AGGREGATES IN TWO DIMENSIONS AND THE FRACTAL PATTERN CALCULATED BY THE WITTEN-SANDER MODEL Interim Report
P. Evesque, C. L. Yang, and M. A. El-Sayed 1 Jul. 1986 19 p
(Contract N00014-83-K-0341)
(AD-A169495; TR-47) Avail: NTIS HC A02/MF A01 CSCL 07/4

Copper metal leaves are experimentally grown in two dimensions by their electrodeposition in a field of circular symmetry from a solution of small thickness. The determined fractal (D) and spectral (d=) dimensions of the deposited aggregates are compared with that determined for the simulated pattern calculated by using the diffusion-limited aggregation method of Witten and Sander using a square lattice. Good agreement is found for the fractal dimension but the value of the spectral dimension, (d=), is found to be 40% larger for the observed pattern. This results from the fact that the observed pattern has more radial symmetry than the calculated one. This implies that the chemical length from the center to the perimeter of the pattern is minimized during the growth. Possible causes for the observed deviation are discussed. GRA

N87-14491# Virginia Univ., Charlottesville. Dept. of Materials Science.
THE USE OF NOVEL PROCESSING PROCEDURES FOR IMPROVING OVERALL FATIGUE RESISTANCE OF HIGH STRENGTH ALUMINUM ALLOYS Annual Report, 1 Jan. - 31 Dec. 1985
Edgar A. Starke, Jr. Apr. 1986 105 p
(Grant AF-AFOSR-0061-83)
(AD-A170136; UVA/525644/MS86/101; AFOSR-86-0492TR) Avail: NTIS HC A06/MF A01 CSCL 11/6

Its objective is to develop an understanding of the mechanisms involved in the initiation and propagation of cracks in metals in order to optimize the microstructure of high strength aluminum alloys for overall fracture resistance. The research conducted during this year was divided into three tasks. Task 1 was concerned with the effects of slip character and grain size on the intrinsic material and extrinsic closure contributions to fatigue crack growth resistance of 7475. It involved the use of thermomechanical processing to modify the grain structure for enhancement of both intrinsic and extrinsic effects. In our last report we described the use of a direct current potential drop technique (DC-PD) to examine the possibility of crack tip welding in vacuum and the results of our initial experiments using this method. Task 2 was concerned with a study of the fatigue crack growth and fracture mechanisms of an Al-Li-Cu alloy. Task 3 was concerned with secondary cracking in Al-Li-Cu, Al-Li-Mg and Al-Li-Cu-Mg alloys. Many recent studies of this class of alloys have shown that they can exhibit severe grain boundary cracking. The most commonly-observed manifestation of this cracking is the appearance of secondary cracks on fracture surfaces of tensile specimens loaded parallel to the rolling direction. GRA

N87-14492# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
A STUDY OF THE FATIGUE BEHAVIOR OF SHORT CRACKS IN NICKEL-BASED SUPERALLOYS Progress Report, 1 Jan. 1984 - 30 Nov. 1985
R. M. Pelloux, G. R. Romanoski, and J. Feng Nov. 1985 38 p
(Grants AF-AFOSR-2928-76; AF-AFOSR-0075-84)
(AD-A170199; AFOSR-86-0224TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

Fatigue behavior of short cracks was studied in Inconel X-750, Inconel 718, Waspaloy and PM-Rene 95. Crack growth rates were measured for crack lengths from 50 microns to 2mm. Three regimes of behavior were generally observed: (1) an initiation regime in which crack propagation rates are nearly zero; (2) a short crack regime in which crack propagation rates increase slowly and variably with crack length but with propagation rates higher than would be predicted by LEFM in the near-threshold regime; and (3) a long crack regime in which conventional fracture mechanics is applicable. The threshold criterion and crack propagation rates for short cracks are shown to be strongly dependent on the stress ratio. Negative stress ratios promotes rapid crack initiation. This

behavior is confirmed theoretically by a Dugdale model which establishes a criterion for crack extension based on the accumulation of plastic work in the crack tip plastic zone. Fractographic investigations show that short cracks propagate in a transgranular-crystallographic mode following a zig-zag path which is macroscopically perpendicular to the applied stress. An experimental technique was developed to generate small eliptical crack initiation sites using a pulsed Nd-YAG laser. An AC potential drop system for continuous and automated measurements of crack length at elevated temperature has been assembled. GRA

N87-14493# Southwest Research Inst., San Antonio, Tex.
STUDY OF THE INFLUENCE OF METALLURGICAL FACTORS ON FATIGUE AND FRACTURE OF AEROSPACE STRUCTURAL MATERIALS Final Report, 1 Jan. 1983 - 31 Dec. 1985
James Lankford, Gerald R. Leverant, David L. Davidson, and Kwai S. Chan Feb. 1986 34 p
(Contract F49620-83-C-0054)
(AD-A170218; AFOSR-86-0493TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report summarizes the results of a two-phase study involving: (1) experimental characterization and analytical modeling of fatigue crack tip micromechanics in aerospace structural (Al and Ti) alloys, and (2) identification and modeling of key factors controlling subcritical crack growth and unstable fracture in single crystal nickel-base superalloys. Fatigue crack growth at near-threshold rates has been modeled using micro-structurally-controlled micromechanical crack tip parameters. The model is based on the concept of crack opening by means of local slip lines whose length and dislocation density are controlled by the alloy microstructure. Crack tip opening displacement, crack tip strain, and the increment of crack advance are micromechanical parameters which depend on the number, spacing, and orientation of the slip lines. Fatigue crack growth mechanisms in Ni-base superalloy single crystals were examined as a function of crystallographic orientation, stress state and slip character. Using compact-tension and tubular specimens, fatigue crack growth in Mar-M200 single crystals of various crystallographic orientations was determined in both unidirectional and multiaxial cyclic loads, at temperatures where the slip character was either localized (25 C) or homogeneous (980 C). GRA

N87-14494# Washington Univ., Seattle. Dept. of Mechanical Engineering.
STABLE CRACK GROWTH IN ALUMINUM TENSILE SPECIMENS
B. S. Kang, A. S. Kobayashi, and D. Post Jul. 1986 41 p
(Contract N00014-85-K-0187)
(AD-A170299; UWA/DME/TR-86/54) Avail: NTIS HC A03/MF A01 CSCL 11/6

Post's white light moire interferometry was used to obtain sequential records of the transient u sub y displacement fields associated with stable crack growth in 7075-T6 and 2024-O, single edge notched (SEN) specimens with fatigued cracks. The u sub y displacement fields were used to evaluate the crack tip opening displacement (CTOD), far and near-field J-integral values, Dugdale strip yield model, William's polynomial function and the HRR fields. GRA

N87-14495# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
MECHANISTIC UNDERSTANDING OF POWDER COMPACTION IN METALS Annual Technical Report, 1 Apr. 1984 - 15 Feb. 1986
Rishi Raj 6 Mar. 1986 37 p
(Grant AF-AFOSR-0133-84)
(AD-A170800; AFOSR-86-0505TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

In this, the first annual report, results from hot-pressing experiments on NixAl(1-x) powders are described. The stoichiometry of the alloy is varied in the range $0.64<x<0.52$. The change in composition allows us to change the diffusion coefficient by nearly two orders of magnitude. The principal mechanisms of powder compaction are plastic flow (by dislocations) and diffusional transport. The relative contribution of these two mechanisms can, therefore, be separated by varying the composition. Also, the dislocation mechanism is expected to dominate when densification is carried out at high stresses. Dislocation activity is also expected to influence microstructure evolution by dynamic recrystallization. The results described in this report demonstrate that the diffusional and dislocation mechanisms can indeed be separated by changing the stress and the composition. At high stresses, we have found evidence of precipitation of new grains at interfaces. Current and future work is being directed toward understanding the role of shear strain in densification and in microstructure evolution during powder compaction. Author (GRA)

N87-14496# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
HIGH TEMPERATURE OXIDATION STUDIES ON ALLOYS CONTAINING DISPERSED PHASE PARTICLES AND CLARIFICATION OF THE MECHANISM OF GROWTH OF SiO(SUB)2 Annual Report, No. 1, 15 Aug. 1985 - 14 Aug. 1986
G. Simkovich 28 Aug. 1986 58 p
(AD-A173210; AFOSR-86-0836TR; AR-1) Avail: NTIS HC A04/MF A01 CSCL 11/6

A relatively wide variety of oxidation tests were conducted on iron-based, cobalt-based and nickel-based alloys. Basically, these tests were conducted on alloys with various concentrations of the alloying elements chromium and/or silicon in the iron matrix with variable additions of Si3N4 particles. The Si3N4 particles dissolved to a major extent in the matrix material and also reacted with any oxygen present. Thus, the final alloy composition was iron + various levels of chromium + silicon at a number of levels + particles of unreacted Si3N4 and SiO2. Kinetic studies were made at a number of temperatures at about 1 atm of dry oxygen. It was found that the rates of oxidation were extremely slow and were comparable to many of the slowest growing commercial alloys. Nickel and cobalt based alloys were also tested with additions of Si3N4 particles and were found to behave in a manner quite similar to that of the iron based alloys described above. A small number of oxidation tests at 1000 C with P sub O2 approx. 1 atm, were also made with additions of SiAlON, a high temperature compound found in the Si-Al-O-N system, to cobalt-chromium alloys. The oxidation behavior of Ni-Cr-SiO2 alloys has also been investigated. The final effort described in this report relates to the electrical short circuiting of SiO2 layers growing on Si(or SiC or Si3N4). GRA

N87-14497# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Engineering.
A STUDY OF FATIGUE CRACK PROPAGATION IN POWDER METALLURGY HOT ISOTATICALLY PRESSED NICKEL-BASE ALLOY Final Report, 1 Jan. 1983 - 30 Jun. 1986
Richard W. Hertzberg 28 Aug. 1986 32 p
(Grant AF-AFOSR-0029-83)
(AD-A173211; AFOSR-86-0920TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

L.C. Astroloy contains a complex distribution of rounded cuboidal gamma prime precipitates (0.1 micrometers edge dimension), cooling gamma prime(0.01 micrometers dia) and prior particle boundary particles of MC, ZrO2, alpha-Al2O3 and M3B2; the majority of MC carbides were not found in conjunction with ZrO2 particles as was previously assumed. Delta K sub th value were found to vary with specimen geometry with lower values being associated with more symmetrical specimen geometries. With four-point bend samples, Delta K sub th increased with increasing grain size, in agreement with previous findings. The present work has identified several anomalies which exist with respect to crack closure measurements and their correlation of FCP. rates. Closure values differed markedly in repeated K-decreasing threshold determinations even though fatigue crack growth rates remained unchanged. The introduction of an artificial asperity in the wake of the crack tip in a 2024 aluminum alloy gave rise to large measured values of closure which had little influence on the crack

growth rates; apparently, crack closure had little influence on associated crack growth rates. GRA

N87-14498# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
AN INVESTIGATION OF THE STRUCTURE AND HIGH TEMPERATURE MECHANICAL PROPERTIES OF OXIDE DISPERSION STRENGTHENED ALLOYS Final Report, 1 Oct. 1980 - 30 Sep. 1985
William D. Nix Sep. 1986 32 p
(Grant AF-AFOSR-0022-81)
(AD-A173356; AFOSR-86-1002TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The research work deals with the structure and mechanical properties of high temperature metals and alloys in which a significant contribution to strengthening is made by dispersed second phase particles. Because the research has been conducted on both aluminum and nickel based alloys, this report is organized along these lines. We have studied, for the first time, the combined effects of oxide dispersion and solute strengthening at high temperatures in an ODS aluminum-magnesium alloy. We find that the oxide particles contribute significantly to the strength at high temperatures, as expected, but that the strength of the ODS alloy at intermediate temperatures is actually lower than that for the solid solution without oxide particles. This suggests that solute strengthening cannot be combined efficiently with oxide strengthening in the design of ODS alloys. Because rapidly solidified aluminum alloys are so similar to ODS aluminum alloys, a study of the high temperature strength properties of Al-Fe-Ce alloys has also been conducted. We find these alloys to be much stronger than ODS aluminum at low and intermediate temperature but they are much weaker than the ODS alloys at very high temperatures. This weakening effect is caused mainly by twinning deformation of the intermetallic particles at high temperatures. This suggests that much more refractory particles, such as oxides or carbides, are needed for high temperature strength. GRA

N87-14499# International Centre for Theoretical Physics, Trieste (Italy).
TEMPERATURE DEPENDENCE OF STRUCTURAL AND TRANSPORT PROPERTIES OF LESS-SIMPLE LIQUID METALS
S. M. Mujibur Rahman and D. K. Sarker May 1985 14 p Prepared in cooperation with Dacca Univ., Bangladesh
(DE86-702770; IC-85/50) Avail: NTIS (US Sales Only) HC A02/MF A01

The shear viscosity and self-diffusion coefficients for certain less-simple liquid metals at various temperatures are calculated. The basic assumption undertaken is that these properties of a liquid metal resemble those of an appropriate hard sphere fluid. The temperature dependence of the basic ingredients, i.e., the hard sphere diameter and packing fraction is considered via a full thermodynamic perturbation formalism. The essential features inherited by these metals are included in the relevant electron-ion interactions. A variational procedure leading to a minimization of the free energy is employed to determine the optimum values of the hard sphere diameters and packing fractions. These optimal and self-consistent ingredients are employed in computing the shear viscosity and self-diffusion coefficients of Ag, Hg, Ga and Sn. The calculated results are found to be in agreement with the experimental and the available theoretical results for most of these metals. DOE

N87-14500# International Centre for Theoretical Physics, Trieste (Italy).
MODEL FOR BIMETALLIC INTERFACES
M. P. Das and N. Nafari Aug. 1985 12 p
(DE86-702901; IC-85/199) Avail: NTIS (US Sales Only) HC A02/MF A01

A theoretical model was developed for bimetallic interfaces by considering the charge rearrangement in the region of the interface. Using the density functional formalism it has been calculated that variationally interfacial energies are due to pairs of semi-infinite jellia in contact. It is inferred that the electronic interaction has an important role in the bimetallic adhesion. DOE

N87-14501# International Centre for Theoretical Physics, Trieste (Italy).
THERMOGRAPHIC INVESTIGATION ON THE THERMOELASTIC EFFECT IN METALS
Y. Huang Nov. 1985 9 p
(DE86-702986; IC-85/276) Avail: NTIS (US Sales Only) HC A02/MF A01

This paper describes the thermodynamical phenomena of thermoelasticity in metals. It also provides a technique in which the thermograph is used for the measurement of temperature change during the deformation process. It is shown that the variation of mechanical properties of metals can be correlated with the temperature change during the elastoplasticity of tensile stress. The thermoelastic effect and its measurement technique are developed as a method, which in particular is used for measuring material properties such as the Gruneisen constant. DOE

N87-14502# Brookhaven National Lab., Upton, N. Y.
THEORY OF ENVIRONMENTAL EFFECTS ON TRANSGRANULAR FRACTURE
K. Sieradzki 1986 31 p Presented at the NATO Workshop on Chemistry and Physics of Fracture, Bad Reichenhall, West Germany, 22 Jun. 1986
(Contract DE-AC02-76CH-00016)
(DE86-016165; BNL-38616; CONF-8606168-2) Avail: NTIS HC A03/MF A01

We discuss recent theoretical work on the transgranular stress-corrosion cracking of ductile metals. Computer simulations were used to study the behavior of cracks coated with thin solid films in the intrinsically ductile 2D triangular Lennard-Jones Solid. The key parameters studied were the elastic modulus mismatch and lattice parameter misfit between the film and substrate. It was found that elastically hard films could induce the nucleation of secondary brittle cracks in the normally ductile substrate. Films with a lattice parameter smaller than the substrate caused the crack to respond in a cleavage cracking mode, whereas films with a larger lattice parameter resulted in dislocation injection into the substrate. The concepts of film-induced cleavage and dynamic embrittlement are discussed. Molecular dynamic simulations were also used to study crack dynamics in the 2D triangular Johnson solid. Additionally we also present analytical calculations which explore the effects of thin film formation at crack tips on fracture. The parameters studied included elastic modulus mismatch, lattice parameter misfit and coherency. Suitable combinations of these parameters lead to film-induced micro-cleavage in ductile substrates. Finally crack dynamics are discussed and an estimation of film-induced micro-cleavage distances is presented. DOE

N87-14503# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
COMPOSITE MODEL OF MICROSTRUCTURAL EVOLUTION IN AUSTENITIC STAINLESS STEEL UNDER FAST NEUTRON IRRADIATION
R. E. Stoller and G. R. Odette (California Univ., Santa Barbara) 1986 40 p Presented at the 13th International Symposium on the Effects of Radiation on Materials, Seattle, Wash., 23 Jun. 1986 Prepared in cooperation with California Univ., Santa Barbara
(Contracts DE-AC05-84OR21400; DE-AA03-76SF-00034)
(DE87-000018; CONF-860605-28) Avail: NTIS HC A03/MF A01

A rate-theory-based model has been developed which includes the simultaneous evolution of the dislocation and cavity components of the microstructure of irradiated austenitic stainless steels. Previous work has generally focused on developing models for void swelling while neglecting the time dependence of the dislocation structure. These models have broadened our understanding of the physical processes that give rise to swelling, e.g., the role of helium and void formation from critically-sized bubbles. That work has also demonstrated some predictive capability by

successful calibration to fit the results of fast reactor swelling data. However, considerable uncertainty about the values of key parameters in these models limits their usefulness as predictive tools. Hence the use of such models to extrapolate fission reactor swelling data to fusion reactor conditions is compromised. DOE

N87-14504# Centre Technique des Industries Mecaniques, Senlis (France).
IONIC DEPOSITS Final Report [DEPOTS IONIQUES]
J. P. Peyre, F. Rohart, N. Segura, and C. Tournier Oct. 1985 264 p In FRENCH
(CETIM-12-F-362; ETN-86-98452) Avail: NTIS HC A12/MF A01

The mechanical characteristics of TiN and TiC coatings made using the vapor phase deposit technique are investigated. A reactor to obtain the coatings was developed. The spectroscopic analysis of the reactor plasma gives valuable indications about the reactior. parameters. Metallurgical analyses were carried out using several techniques, including electron microscopy and radio crystallography. Acoustic emission methods were employed to measure the ductility of the coatings. The measured characteristics are discussed and applications are suggested. ESA

N87-14505# Centre Technique des Industries Mecaniques, Senlis (France).
HOT FORMING OF THICK PLATES Final Report [FORMAGE A CHAUD DE TOLE EPAISSE]
M. Marez, M. Lacomblez, and M. Rigal Oct. 1985 78 p In FRENCH Original document contains color illustrations
(CETIM-13-J-122; ETN-86-98453) Avail: NTIS HC A05/MF A01

Steel forming thermomechanical processes are studied in order to identify parameters that would make unnecessary any further thermal treatment. The cycles considered include heating at temperatures higher than the AC3 point, heating equivalent to normalizing temperature but with final forming temperature higher than AC3, and final forming temperature less than AC3 tests. Tests included the mechanical characterizations of the formed product. Results show that using cycle end temperatures higher than AC3 the goal is reached when the total strain is limited to 25%. The influence of heating time and other parameters is also discussed. ESA

N87-14506# Metallgesellschaft, A.G., Frankfurt am Main (West Germany).
TESTING OF HIGH ALLOY STEELS FOR NEW HYDROMETALLURGICAL PROCESSES AND CHEMICAL PLANTS Final Report, Jun. 1985
Edelgard Altpeter and Michael Renner Bonn, West Germany Bundesministerium fuer Forschung und Technologie Aug. 1986 109 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-055; ISSN-0340-7608; ETN-86-98768) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23

Autoclave tests with an ore suspension for the sulfuric pressure leaching of sphalerite at 160 C (320 F) reveal that, in the presence of oxygen, CrNiMo-steels and NiCrMo-alloys show corrosion rates of less than 0.1 m m/a. To improve the use of waste heat in chemical plants, especially in sulfuric acid plants, the acid temperatures must be increased. A number of CrNiMo-steels and NiCrMo-alloys were tested in high concentrated sulfuric acid (95 to 98.7 C) under stagnant and flowing conditions as to their corrosion behavior. Optimum corrosion properties under stagnant conditions are achieved with Nicrofer 3127 L C/Alloy 28 showing a limit application temperature of 125 C (257 F) (0.27 m m/a) and, under flowing conditions at 100 C, Cronifer 1815 L C Si/Alloy 306 (0.15 m m/a). Metallographic and scanning electron microscopic investigations prove the flow dependency of the corrosion behavior of nearly all materials; erosion and cavitation corrosion are observed. ESA

N87-14507# Technische Hochschule, Aachen (West Germany). Inst. fuer Maschinenelemente und Maschinengestaltung.
DEVELOPMENT OF A SUITABLE POWDER METAL ON IRON BASE FOR GENERAL USE IN HIGHLY LOADED SLIDE BEARINGS Final Report, Nov. 1984
Heintz Peeken and Gerd Hermes Bonn, West Germany Bundesministerium fuer Forschung und Technologie Aug. 1986 56 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-056; ISSN-0340-0768; ETN-86-98769) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12

In order to substitute conventional bearing materials on the base of copper, tin and lead by iron materials, powder metallurgy was chosen because it is possible to create many materials and get surfaces of high quality. The demand for high dynamical strength and run ability must be accomplished. Investigations of the fatigue strength of bending-test specimens under statistical evaluation of failure probability proves superior compared with conventional bearing materials. Investigations on real slide bearings by measuring the pressure distribution by making running-out experiments to determine the load capacity limit show reduced characteristics in contrast to conventional bearing materials. The reasons can be found in the porosity of the shell, deviation from the cylinder, the high shear strength, and the high Young's modulus. ESA

N87-14508# Hoesch Stahl A.G., Dortmund (West Germany).
INVESTIGATION OF THE PRODUCTION OF UNCOATED AND COATED SHEET STEEL IN A CONTINUOUS ANNEALING LINE Final Report, Dec. 1984
Bernhard Engl and Yves Guinomet Bonn, West Germany Bundesministerium fuer Forschung und Technologie Feb. 1986 145 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-021; ISSN-0340-7608; ETN-86-98295) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 30.50

A continuous annealing process was integrated in an existing production line. Requirements for the material in the production route, evaluation of the annealing conditions, and the integration of a metallic surface treatment in the processing line are described. Results show the importance of the processing conditions before annealing. Continuous annealing allows the production of low alloy and economically favorable high strength steels. The clean sheet surface and the good weldability are emphasized. High speed depositions after the annealing using zinc as main component of the coating give the best results. ESA

N87-14509# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.
THE INFLUENCE OF THE POURING RATE ON THE MECHANICAL PROPERTIES OF SAND CASTINGS MADE OF THE ALLOY G-AlSi7Mg. BUILDING AND TESTING OF A LOW PRESSURE SAND CASTING MACHINE Thesis [DE INVLOED VAN DE VULSNELHEID OP DE MECHANISCHE EIGENSCHAPPEN VAN DUNWANDIG ZANDGIETWERK VAN G-ALSI7MLCG. DE BOUW EN INGEBRUIKNAME VAN EEN LAGEDRUK GIETMACHINE]
Benedict Lefeber May 1986 80 p In DUTCH; ENGLISH summary
(ETN-86-98702) Avail: NTIS HC A05/MF A01

A computer controlled low pressure casting machine which can pour the liquid metal in the desired reproducible way was built and tested. The vertical liquid velocity can be varied up to 50 cm/sec. After the filling of the mold, a hydrostatic pressure is kept on the liquid metal to improve the feeding during solidification. One of the main solved problem was the determination of the correct relationship between the pressure in the machine and the vertical liquid velocity. The influence of the pouring rate on the structure and mechanical properties of G-AlSi7Mg was determined by tests with casting plates. The deadrite arm spacing, local solidification time, tensile strength, yield strength and elongation are given as a function of the pouring rate and the position in the place. Relationships between the different properties of the plates are discussed. ESA

N87-14510# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
STUDY OF THE Ti 15-3-3 TITANIUM ALLOY IN THIN PLATE FORM [ETUDE DE L'ALLIAGE DE TITANE TLCI 15-3-3 SOUS FORME DE TOLE MINCE]
J. Blaizot 21 Nov. 1985 66 p In FRENCH
(Contract STPA-83-96-013)
(SNIAS-45-656; ETN-87-98579) Avail: NTIS HC A04/MF A01

Tests were carried out on 2 mm thick titanium alloy plates to characterize this alloy in order to use it in thin components of aerospace structures. The analysis included heat treatments, mechanical characterization, corrosion behavior, and welded joints characterization. The results show that the alloy can be cold worked in metal forming procedures or welded after heat treatment. Fragility is found when treated at 1300 MPa. ESA

N87-14511# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
FRACTURE: A NOVEL TECHNIQUE TO INVESTIGATE THE HIGH TEMPERATURE OXIDATION OF THE 20%Cr/25%Ni/Nb STAINLESS STEEL
J. A. Desport Mar. 1986 28 p
(AERE-R-11937) Avail: NTIS HC A03/MF A01

Simple procedures have been developed for the preparation by fracture of transverse corroded metal sections for subsequent examination of the microstructure and microchemistry of the corrosion attack by scanning electron microscopy. The procedures involved the fabrication of miniature H-shaped tensile specimens from the corroded metal to ensure fracture within a defined location. Tensile fracture was undertaken using a standard vice modified only to clamp the specimens. Examination of 20Cr/25Ni/Nb stainless steel following 120 h oxidation in carbon dioxide at 1000 C confirmed that the essentially three-dimensional picture revealed by fracture provided additional microstructural information not apparent from optical microscopy of standard metallographically mounted sections. The size and morphology of the oxide grains constituting the various layers of the uniform protective and the pitting types of attack were established. Nearest to the underlying steel a band of the inner Cr2O3 layer contained a high but variable silicon concentration and also substantial voidage. Silica intrusions dramatically influenced the mechanical properties of the 20/25/Nb stainless steel to the depth of this intergranular attack, as fracture at 78 K occurred by a brittle mode. Steel unaffected by oxidation, however, continued to remain ductile. Author

N87-14512# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
EFFECT OF SPECIMEN SIZE AND GEOMETRY ON DUCTILE CRACK GROWTH RESISTANCE IN C-Mn STEEL
G. P. Gibson and S. G. Druce Feb. 1986 43 p
(AERE-R-12138) Avail: NTIS HC A03/MF A01

The effect of specimen size and geometry on the ductile crack growth resistance of a C-Mn steel has been investigated. The resistance, expressed in the form of J-R curves, was measured using the conventionally calculated J(J sub r) and the Ernst modified J(J sub m) in a range of specimen geometries loaded in bending and tension. The overall resistance of the non-sidegrooved specimens was apportioned into contributions arising from the flat fracture and shear tip regions found on the fracture surfaces. Using this approach, the effects of specimen size and geometry have been rationalized, and the limits of (J sub r) and (J sub m) controlled crack growth determined in terms of the maximum allowable crack extension and minimum w(b/J x dJ/da) values. The results show that for specimens of given thickness the effect of specimen geometry was due to a change in the shear tip and not the flat fracture contribution. This conclusion is consistent with the geometry invariance found in measurements of the crack opening displacement at the growing crack tip in the flat fracture region. In addition, it has been shown that J sub m can characterize crack growth resistance over a wider range of conditions than J sub r. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N87-14513 National Physical Lab., Teddington (England). Div. of Materials Applications.
COMMISSIONING TRIALS ON A LARGE-AREA THERMAL CONDUCTANCE APPARATUS AND THE THERMAL PERFORMANCE OF A CERAMIC FIBRE FURNACE LINING
W. P. Byrne and J. M. Cox May 1986 90 p
(NPL-DMA(A)-85; ISSN-0143-7313; ETN-86-98351) Copyright. Avail: Issuing Activity

Commissioning trials on a large-scale thermal-conductance apparatus to provide data on the thermal performance of furnace insulations are summarized. Calibration of the calorimeter system, overall performance trials, and heat-flow calculations on an example test wall are described. Data on thermal aging, orientation, and hot-face coating of a furnace lining are given to show their effects on insulation performance. A means for relating furnace-case temperatures to heat-flow rates to monitor furnace behavior is outlined. A simple method for the determination of specific heats over a range of temperatures based on cooling-rate measurements which can be used with standard hot-plate tests to obtain data on insulation performance under transient conditions is suggested. ESA

N87-14514 Materials Quality Assurance Directorate, London (England). Materials Center.
THE PERFORMANCE OF ZINC PHOSPHATE TWO-PACK EPOXY PRIMERS
A. Chambers Feb. 1986 13 p
(MQAD-TP-917; BR98858; ETN-87-98620) Avail: Issuing Activity

Proprietary zinc phosphate two-package epoxy primers, with a range of zinc phosphate levels, were applied over steel and subjected to environmental trials using chromate based two-package epoxy primers as controls. The zinc phosphate primers were then incorporated into specification TS 50086C and DTD 5555A paint systems in place of the normal chromate primer, and these systems were tested against the requirements of the appropriate specification. Results indicate that zinc phosphate primers applied over steel produce a similar level of performance to chromate based primers provided that a minimum level of 35% zinc phosphate, based on total pigment, is used. ESA

N87-14515* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 5-(4-ETHYNYLOPHENOXY) ISOPHTHALIC CHLORIDE Patent
Paul M. Hergenrother and Brian J. Jensen, inventors (to NASA) Issued 11 Nov. 1986 7 p Division of US-Patent-4,587,312, US-Patent-Appl-SN-613139, filed 23 May 1984
(NASA-Case-LAR-13316-2; US-Patent-4,622,182; US-Patent-Appl-SN-760791; US-Patent-Class-260-544-P) Avail: US Patent and Trademark Office CSCL 07A

Sulfone-ester polymers containing pendent ethynyl groups and a direct and multistep process for preparing them are disclosed. The multistep process involves the conversion of a pendent bromo group to the ethynyl group while the direct route involves reating hydroxy-terminated sulfone oligomer or polymers with a stoichiometric amount of 5-(4-ethynylphenoxy) isophthaloyl chloride. The 5-(4-ethynylphenoxy) isophthaloyl chloride and the process for preparing it are also disclosed.
Official Gazette of the U.S. Patent and Trademark Office

N87-14516* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACETYLENE (ETHYNYL) TERMINATED POLYIMIDE SILOXANE AND PROCESS FOR PREPARATION THEREOF Patent
Terry L. StClair and Shubha Maudgal, inventors (to NASA) (National Academy of Sciences - National Research Council, Washington,

D. C.) Issued 25 Nov. 1986 6 p Filed 30 Sep. 1985 Supersedes N86-21685 (24 - 12, p 1927)
(NASA-Case-LAR-13318-1; US-Patent-4,624,888; US-Patent-Appl-SN-781813; US-Patent-Class-428-262; US-Patent-Class-428-447; US-Patent-Class-528-26) Avail: US Patent and Trademark Office CSCL 11B

Siloxane containing addition polyimides having improved physical property characteristics of flexibility, drape, tack, and toughness and the process for preparing and utilizing the same are disclosed. The novelty of this invention appears to reside in the composition and process of preparing addition type polyimides useful as structural adhesives as well as composite matrix materials and the process of preparing the same.

Official Gazette of the U.S. Patent and Trademark Office

N87-14517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER REINFORCED CERAMIC MATERIAL Patent Application
Ramakrishna T. Bhatt, inventor (to NASA) Filed 16 Jul. 1986 14 p
(NASA-Case-LEW-14392-1; NAS 1.71:LEW-14392-1; US-Patent-Appl-SN-886149) Avail: NTIS HC A02/MF A01 CSCL 71O

Alternate layers of mats of specially coated SiC fibers and silicon monotapes are hot pressed in two stages to form a fiber reinforced ceramic material. In the first stage a die is heated to about 600 C in a vacuum furnace and maintained at this temperature for about one-half hour to remove fugitive binder. In the second stage the die temperature is raised to about 1000 C and the layers are pressed at between 35 MPa and 138 MPa. The resulting preform is placed in a reactor tube where a nitriding gas is flowed past the preform at 1100 C to 1400 C to nitride the same. NASA

N87-14518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE EFFECT OF HYDROGEN ON SINTERED ALPHA-SILICON CARBIDE
Gary W. Hallum and Thomas P. Herbell 1986 25 p Presented at the 88th Annual Meeting of the American Ceramic Society, Chicago, Ill., 27 Apr. - 1 May 1986
(NASA-TM-88819; E-3180; NAS 1.15:88819) Avail: NTIS HC A02/MF A01 CSCL 11G

Sintered alpha-silicon carbide was exposed to pure, dry hydrogen at high temperatures for times up to 500 hr. Weight loss and corrosion were seen after 50 hr at temperatures as low as 1000 C. Corrosion of SiC by hydrogen produced grain boundary deterioration at 1100 C and a mixture of grain and grain boundary deterioration at 1300 C. Statistically significant strength reductions were seen in samples exposed to hydrogen for times greater than 50 hr and temperatures above 1100 C. Critical fracture origins were identified by fractography as either general grain boundary corrision at 1100 C or as corrosion pits at 1300 C. A maximum strength decrease of approximately 33 percent was seen at 1100 and 1300 C after 500 hr exposure to hydrogen. A computer assisted thermodynamic program was also used to predict possible reaction species of SiC and hydrogen. Author

N87-14519# Naval Research Lab., Washington, D. C.
OXIDATION OF SILICON, SILICON CARBIDE (SiC) AND SILICON NITRIDE (Si3N4) Interim Report
K. H. Stern 4 Jun. 1986 63 p
(AD-A168886; NRL-MR-5774) Avail: NTIS HC A04/MF A01 CSCL 07/4

Si, SiC, and Si3N4 are important materials, widely used for their electrical properties in the construction of semiconductor devices. SiC and Si3N4 have important uses as hard and relatively oxidation-resistant ceramics. The carefully controlled oxidation of Si to SiO2 is used in the fabrication of semiconductors. Because of the many similarities in the oxidation chemistry of the three substances, they are treated together in this report so that useful comparisons can be made. The major questions to be addressed are: what are the oxidation reactions and what is the detailed mechanism by which they occur; how do these oxidation processes depend on: (1) the form that the material takes, e.g., processing procedure, crystal structure, (2) temperature, and (3) oxygen pressure. Although other oxidants, e.g., H2O, either alone or in combination with O2 also oxidize these materials, this report will deal with O2 exclusively. Each of the above questions will be addressed for each of the three materials. GRA

N87-14520# Honeywell, Inc., Bloomington, Minn. Physical Sciences Center.
A CLASS OF NARROW BAND GAP SEMICONDUCTING POLYMERS
Samson A. Jenekhe 25 Jun. 1986 16 p
(Contract N00014-84-C-0699)
(AD-A169507; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/12

Scientific interest in electrically conducting polymers and conjugated polymers in general has been widespread, and continues to grow, among workers in polymer science, chemistry, condensed matter physics, materials science, and related fields since the discovery of doped conductive polyacetylene. Numerous doped conducting organic polymers with conductivity spanning the insulator to near metallic range (approx. 10 to the -15th power to 1,000/ohm/cm) are not known. Of prime importance and fundamental interest in the continuing experimental and theoretical search for new conducting, and perhaps superconducting, polymers is achievement of small or vanishing semiconductor band gap (E sub g) which governs the intrinsic electronic, optical, and magnetic properties of materials. Existence of a finite E sub g in conjugated polymers is thought to originate principally from bond-length alternation which is related to the Peierls instability theorem for one-dimensional metals. Here is described a novel class of conjugated polymers containing alternating aromatic and quinonoid segments whose members exhibit intrinsic band gaps as low as 0.75 ev, the smallest known value of E sub g for organic polymers. The idea that introduction of quinonoid character into a polymer main chain could lower the band gap is experimentally demonstrated and the effect described in terms of molecular parameters and bond-length alternation. GRA

N87-14521# Army Materials Technology Lab., Watertown, Mass.
SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS (SHS): CURRENT STATUS AND FUTURE PROSPECTS Final Report
Normand D. Corbin and James W. McCauley May 1986 18 p
(AD-A169588; AD-E500769; MTL-MS-86-1) Avail: NTIS HC A02/MF A01 CSCL 11/2

Conventional ceramic processing normally consists of two stages: first, a powder having the desired physical and chemical characteristics is prepared, then it is heated to promote interparticle bonding (sintering) and densification. This generally requires high temperature (1200 to 2000 C) and controlled atmospheres (vacuum - high pressure). Often the sintering stage may require up to several days to complete. An alternative method termed Self-Propagating High-Temperature Synthesis (SHS) is described. The process utilizes the heat generated by an exothermic reaction between precursor components to densify the resulting reaction products. The heat generated by these reactions is capable of producing temperatures in excess of 2500 C. Since the heat is self-generated, high temperature furnaces are not required. Processing times are on the order of seconds/minutes rather than hours/days as in conventional processes. In addition to these attributes, products produced by SHS are found to be of higher purity than the starting materials since the high temperatures vaporize the volatile contaminants. Further, intractable borides and carbides can be produced by this technique. GRA

N87-14522# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
PROCEEDINGS OF THE ASILOMAR CONFERENCE ON POLYMERS (9TH) HELD ON FEBRUARY 9-12, 1986 AT ASILOMAR, CALIFORNIA Final Report, 1 Jan. - 30 Jun. 1986
Eric Baer Jun. 1986 20 p Conference held in Asilomar, Calif., 9-12 Feb. 1986
(Grant DAAL03-86-G-0012)

(AD-A170066; ARO-23470.1-MS-CF) Avail: NTIS HC A02/MF A01 CSCL 11/9

The conference was held as scheduled. Topics discussed included composites as orthopedic implants, ceramic particles in colloidal systems, polymers in information systems, multiplayer composites, crystalline polymers, amorphous polymers, crystalline polymers and cellulose fibers. GRA

N87-14523# Pittsburgh Univ., Pa. Dept. of Materials Science and Engineering.

ADVANCED HIGH TEMPERATURE COATING SYSTEMS BEYOND CURRENT STATE OF THE ART SYSTEMS Final Technical Report, 1 Jan. 1980 - 31 Dec. 1984

A. Ashary, G. H. Meier, and F. S. Pettit 15 Apr. 1986 143 p

(Grant AF-AFOSR-0089-80)

(AD-A170192; AFOSR-86-0481TR) Avail: NTIS HC A07/MF A01 CSCL 11/3

Alpha-Al2O3 and the SiO2 are the two most effective reaction product barriers that can be used to protect alloys from oxidation at temperatures above 1000 C. In the present work the techniques to improve the adherence of Al2O3 scales on MCrA1 coating alloys are studied and the characteristics of SiO2 scales formed on Ni-Si alloys are investigated. The theoretical aspects of oxide-metal adhesion are examined and the factors which affect the adherence of oxide scales in general are clearly defined. A critical review of the previously proposed mechanisms of the improved scale adherence by active element additions is presented. Experimentally, the effects of small additions of yttrium and hafnium on the isothermal and cyclic oxidation behavior of MCrAl type alloys are studied. The base alloys used in the study of Al2O3 scale adherence were Ni-20wt%Cr-1Owt%Al and Co-20wt%Cr-10wt%Al. Both the isothermal and the cyclic oxidation tests were carried out at 1100 C for varying durations. Emphasis is given to the in situ study of the oxide scale failure process. An acoustic emission (AE) technique was employed for this purpose. The above study indicates that the Al2O3 scale failure processes are quite different in the doped (i.e., containing oxygen active elements) and updoped alloys. Although both yttrium and hafnium can be very effective in improving the adherence of Al2O3 scales, there are some basic differences in their oxidation behavior in alloys. GRA

N87-14524# Pratt and Whitney Aircraft, West Palm Beach, Fla. Engineering Div.

LABORATORY SPECTROMETER FOR WEAR METAL ANALYSIS OF ENGINE LUBRICANTS Final Report, 15 Jul. 1984 - 15 Jun. 1985

M. E. Rippen, T. Gilbert, and T. OHaver Apr. 1986 110 p

(Contract F33615-84-C-2400)

(AD-A170338; PW/ED/FR-18951; AFWAL-TR-85-2101) Avail: NTIS HC A06/MF A01 CSCL 11/8

A search was conducted to define all potential spectrometric approaches for conducting wear metal analysis in engine lubricating fluids. The techniques identified were subjected to an analysis of their design and performance characteristics. The resultant data were used to determine which methods had sufficient potential for meeting the needs of the Joint Oil Analysis Program (JOAP) through the year 2000. The most promising candidate techniques were then ranked through a factorial analysis on the basis of the following criteria: analysis time; elemental capability/range; reliability/maintainability; size/weight; unit cost; consumables requirements; sample costs; safety; automation for sampling, calibration, and data reduction; simplicity of design; simplicity of operation; environmental operating limits; CRT, printer and data system capabilities; particle size capabilities; self-diagnosis/modular construction; reduced operator dependence; data management methods and capacity to interface with current JOAP data bases; and logistics and maintenance costs. An inductively coupled plasma simultaneous atomic emission spectrometer with auto-dilution and auto-sampling was found to be the best instrumental approach for supporting JOAP needs through the year 2000. GRA

N87-14525# Utah Univ., Salt Lake City. Dept. of Physics.

CURRENT NOISE IN SODIUM BETA ALUMINA CERAMICS AND SINGLE CRYSTALS Technical Report, Sep. 1985 - Aug. 1986

James J. Brophy 1 Aug. 1986 17 p

(Contract N00014-82-K-0603)

(AD-A170412; ONR-TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/3

Conductivity fluctuations and contact noise observed in ceramic and single crystal silver beta double prime alumina are very similar to those in sodium beta double prime alumina. The current noise spectral density varies as f to the -3/2 power, indicative of diffusion noise, and is thermally activated with an activation energy of 0.5 eV, significantly smaller than for sodium beta double prime alumina. In both materials, single crystal specimens are noisier than the ceramics and the granular nature of the ceramics does not seem important in the diffusion noise process. The standard expression for diffusion noise is unable to account for either the observed noise magnitude or the temperature or the temperature dependence. GRA

N87-14526# Corning Glass Works, N.Y.

FLUORIDE GLASSES FOR BULK OPTICAL AND WAVEGUIDE APPLICATIONS Final Report, 15 Aug. 1984 - 14 Aug. 1985

P. A. Tick Jan. 1986 21 p

(Contract F49620-84-C-0098)

(AD-A170750; AFOSR-86-0570TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

The overall goal of the research was to develop a wide transmission window heavy metal fluoride glass (HMFG) which could eventually be compatible with chemical vapor deposition (CVD) forming. During the first two years of contract work, new glasses were identified and the basic chemistry and properties of the system determined. Since the intent of the work is to use such glasses for bulk IR optics or for ultra-low-loss OWG fibers, further characterization was required. It remained to establish the utility of these glasses as practical infrared transmitting materials. This required that a method for removing water be found and that the effects of infrared absorbing impurities be determined. Work in these two areas constituted much of the recent effort. GRA

N87-14527# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

THE INTERFACIAL AND COMPRESSIVE PROPERTIES OF POLYBENZOTHIAZOLE FIBERS Final Report, Jan. - Dec. 1984

L. T. Drzal Jun. 1986 35 p

(AD-A171620; AFWAL-TR-86-4003) Avail: NTIS HC A03/MF A01 CSCL 11/4

Evaluated are the interfacial and compressive properties of polyparaphenylenebezobisthiazole (PBT) fibers in an epoxy matrix (Epon 828, Shell Chemical Co., cured with metaphenylenediamine). The interfacial shear stress was measured by the single fiber tensile coupon method, while wettability of the fiber was determined from the contact angle. A technique was developed for measuring compressive strength of single fibers by placing a matrix-embedded fiber in axial compression, and observing microscopically the onset of kinking or fracture in the fiber. The difficulty in developing adhesion between PBT fibers and epoxy matrices appears to be due to three factors: (1) the surface of the PBT fiber is thermally stable and very non-reactive making traditional methods of improving fiber-matrix adhesion inoperative; (2) the Poisson's ratio of the PBT fiber is greater than that of the typical structural matrices used in advanced composites, which results in a net tensile interfacial force causing separation of the fiber and matrix under tensile loading conditions; and (3) the fibrillar nature of the fiber causes interfibrillar failure under shear loading which is the upper limit axial shear strength. The interfacial shear strength attainable with the PBT fibers and epoxy is only of the order of 1.5 ksi versus the value of 3.6 ksi obtained with Kevlar-49 in the same matrix. The compressive strength of PBT fibers is substantially below that of the tensile strength of the same fibers. GRA

N87-14528# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
A REPORT SUMMARY OF ACTIVITIES AND RESULTS RELATED TO ADHESIVE BONDING
W. G. Knauss 10 Sep. 1986 108 p
(Contract N00014-84-K-0424)
(AD-A173208; GALCIT-SM-86-20) Avail: NTIS HC A06/MF A01 CSCL 11/1

The program at the California Institute of Technology on adhesive bonding has several objectives which are related to improve the design/analysis capability for the durable application of bonded joints. The more specific intention is to develop analytical methods which establish or improve the predictive power for computing stresses and failure in bonded joints. The topics under consideration are primarily mechanics oriented, but draw on the interdisciplinary fields of polymer mechanics. Under the latter discipline we understand those topics that deal with the molecular structure and with polymer chain mechanics from a microscopic basic physical properties of the bonded-joint components and their interaction. The disciplines under study are categorized most easily according to the size scale of the phenomena; these are listed first and then explained in some detail in terms results obtained and prospects: (1) Effect of carrier cloth on adhesive modulus; (2) Analytical material representation in terms of smooth relaxation or retardation spectra; (3) Thermo-mechanical behavior of adhesive materials; (4) Nonlinearly viscoelastic adhesive behavior; (5) Bond enhancement via ion bombardment. GRA

N87-14529# Sandia National Labs., Albuquerque, N. Mex.
SURFACE CHEMISTRY OF CERAMIC THIN FILM AND POWDER SURFACES
C. H. F. Peden 1986 3 p Presented at the DOE/BES/MS Review Program Conference, Albuquerque, N. Mex., 21 Jul. 1986
(Contract DE-AC04-76DP-00789)
(DE86-012657; SAND-86-1550C; CONF-860749-1) Avail: NTIS HC A02/MF A01

As part of a program to prepare ultra-pure silicon-nitride (Si3N4) powders for consolidation studies, we are concerned with preventing the oxidation of the powders which occurs upon exposure to air. In order to study the oxidation kinetics of a Si3N4 surface, we have been preparing a model system by nitriding a Si(100) single crystal with ammonia (NH3) and hydrazine (N2H3) in ultrahigh vacuum (uhv). Such a procedure yields a thin film of silicon-nitride grown on the single crystal substrate. Further, a determination of the growth kinetics of the nitrided film will enable control of the film thickness. These latter studies are the focus of this report. Studies such as these are expected to have an impact on semiconductor technology where thermally grown silicon-nitride layers are widely used as passivating and dielectric thin films. Understanding of the initial stages of the nitriding process obtained in our studies will be particularly useful as the industry moves to ever smaller circuits in IC's for VLSI devices. DOE

N87-14530# Florida State Univ., Tallahassee.
POLYMERS IN MECHANOCHEMICAL SYSTEMS: STRUCTURE-PROPERTY REQUIREMENTS Final Report, 1 Jun. 1980 - 30 Nov. 1985
L. Mandelkern 28 Feb. 1986 14 p
(Contract DE-AS05-80ER-10655)
(DE86-014308; DOE/ER-10655/T3) Avail: NTIS HC A02/MF A01

The research described was concerned with the property structure relations in semi-crystalline polymers with emphasis on mechanical, ultimate and relaxation properties. Key to the program was the ability to identify the key structural variables which govern the properties of the crystalline state and to vary these by control of molecular weight, chain constitution and crystallization conditions. Following this strategy we have completed in depth studies and analysis of the alpha and beta dynamic mechanical transitions in the polyethylenes, the carbon-13 nmr crystalline spin lattice relaxation time and the stress-strain and ultimate properties of the polyethylenes which were taken to serve as model semi-crystalline polymers. From these findings a molecular understanding of these phenomena can be developed. DOE

N87-14531# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
HIGH TEMPERATURE PROPERTIES AND PROCESSES IN CERAMICS: THERMOMIGRATION Final Report
B. J. Wuensch Jul. 1986 22 p
(Contract DE-AC02-76ER-02923)
(DE86-015035; DOE/ER-02923/6) Avail: NTIS HC A02/MF A01

Results are reported on: growth of single-crystal MgO by chemical transport, anion self-diffusion in MgO, and time-dependent solutions for diffusion in a temperature gradient. Directions for future research are discussed in detail for: self-diffusion in single-crystal alkaline earth oxides; grain-boundary diffusion in clean bicrystals, dependence of oxygen self-diffusion on oxygen partial pressure, isotope effect for oxygen self-diffusion, and thermomigration and heats of transport. DOE

N87-14532# Northeastern Univ., Boston, Mass.
SPECTROSCOPIC CHARACTERIZATION STUDIES OF PHASE TRANSFORMATIONS IN ZIRCONIA, HOLLANDITE AND GRAPHITE SYSTEMS Final Technical Report, 14 Feb. 1984 - 14 Oct. 1985
C. H. Perry 1986 7 p
(Contract DE-FG02-84ER-45079)
(DE86-015069; DOE/ER-45079/T2) Avail: NTIS HC A02/MF A01

This document is divided into the following: structural transformation analysis of the ZrO2-Y2O3 system using Raman spectroscopy; effects of incommensurability on the 1-D superionic conductor K - hollandite (K/sub 2x/Mg/sub x/Ti/sub8-x/O16; x = 0.77); and effect of high pressure (0 to 25 kbars) on graphite and graphite intercalated compounds. DOE

N87-14533# Centre d'Essais Aeronautique Toulouse (France). Lab. Chimie Inflammabilite.
PHYSICAL-CHEMICAL CHARACTERIZATION OF THE 2220-3 RESIN IN THE AS4/2220-3 PREIMPREGNATED MATERIAL, TEST REPORT, PART 1 [CARACTERISATION PHYSICO-CHIMIQUE DE LA RESINE 2220-3 SUR LE PREIMPREGNE AS4/2220-3]
27 May 1986 52 p In FRENCH
(Rept-M4-475000-Pt-1; CEAT-C78-Pt-1; ETN-86-98431) Avail: NTIS HC A04/MF A01

Resin 2220-3 carbon epoxy composite was characterized using infrared spectrum, liquid chromatographic, differential calorimetric, and thermogravimetric techniques in addition to chemical analysis. The results show that the resin includes DDS at 9.9%, with 1.47 nitrogen, and 260.5 epoxy equivalents. Polymerization enthalpy is 90.2 cal/g. Data on degradation and aging are included. ESA

N87-14534# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
ELUCIDATION OF THE ADHESION MECHANISMS IN STRUCTURAL ALUMINUM BONDINGS Final Report, Nov. 1984
Christoph Matz Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 98 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-008; ISSN-0170-1339; ETN-86-98761) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.50

The properties of the components of a structural Al-bond (metal, oxide, primer, adhesive) were investigated and their interrelationships described. Besides segregation phenomena in the polymeric materials, two degredation mechanisms were registered and their parameters elucidated. A solid base which enables an effective development and optimization of Al-bonds was created. ESA

N87-14535# Construcciones Aeronauticas S.A., Madrid (Spain). Servicio Tecnico de Aplicaciones y Desarrollo Comercial.
LOW CONTRACTION ADDITIVES FOR POLYESTER RESINS [ADITIVOS PARA BAJA CONTRACCION EN RESINAS DE POLIESTER]
M. A. Areso 1986 14 p In SPANISH
(ETN-86-98563) Avail: NTIS HC A02/MF A01

The compensation of thermal contraction by using thermoplastic additives in glass fiber reinforced polyesters used in automobile manufacturing is described. A single component system is chosen. The chemical resemblance of resin and additive allows a low viscosity preimpregnation without increase of the styrene solvent concentration. The mechanical properties of the reinforced product are given. Other applications such as injection and extrusion, are discussed. ESA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N87-14536# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA ARMAMENTARII (SELECTED ARTICLES)
8 Jul. 1986 35 p Transl. into ENGLISH from Binggong Xuebao (Communist China), no. 2, May 1985 p 26-31, 49-58
(AD-A170158; FTD-ID(RS)T-0069-86) Avail: NTIS HC A03/MF A01 CSCL 19/1

The instantaneous optical image ot the combusition process of two propellants is transformed to numerical signals by a CCD line scan camera. The average burn rate and pressure exponent were obtained. The dynamic mechanical properties of composite modified double-base (CNDB), double-base (DB), and polyvinyl chloride (PVC) composite propellants were measured respectively with a Rheovibron visco elastometer. The effects of three solid fillers on the dynamic mechanical properties of the double-base binder were studied. B.G.

N87-14537# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELECTRICAL CONDUCTANCE OF LIQUID PROPELLANTS: THEORY AND RESULTS Final Report
John A. Vanderhoff, Steven W. Bunte, and Philip M. Donmoyer Jun. 1986 39 p
(AD-A170361; BRL-TR-2741) Avail: NTIS HC A03/MF A01 CSCL 19/1

An overview of the development of the theory of electrical conductance of electrolytes is presented. Conditions where ion-pairing can occur is emphasized. Electrical conductance versus both concentration and temperature is reported for aqueous hydroxylammonium nitrate (HAN) solutions. Electrical conductance versus temperature is reported for liquid gun propellants LGP 1845 and LGP 1846. Possible local molecular structure consistent with the observed data is discussed. GRA

N87-14538# Clemson Univ., S.C. Dept. of Chemistry and Geology.
INTRAMOLECULAR ENERGY TRANSFER REACTIONS AS A METHOD FOR METAL COMPLEX ASSISTED PRODUCTION OF HYDROGEN Progress Report, 1 Jul. 1985 - 30 Jun. 1986
J. D. Petersen 13 Jun. 1986 5 p
(Contract DE-AS09-80ER-10671)
(DE86-013217; DOE/ER-10671/4) Avail: NTIS HC A02/MF A01

The polymetallic systems involving 2,2'-bipyridine (bpm) have shown only one breakthrough in the previous twelve-month period. We have, however, been successful with one such synthetic procedure in that we have recently prepared (bpy)2Ru(bpm)Rh (PPh3)2H(sup 3)(sub 2). An additional study involved systems in which bpm is bridged to tetracyanoferrate units. Because of the difficulty in deprotonating 2,2'-biimidazole and 2,2'-bibenzenebiimidazole, we have discontinued work with these anionic ligands. We are attempting to prepare the 4,4',5,5'-tetracyano derivative which should undergo more facile deprotonation and supply a good di-negatively charged bridging ligand. We have experienced a substantial progress in the proposed research using 2,3-bis(2'-pyridyl)pyrazine as a bridging ligand. This ligand has been used to couple Ru(II) units to form L2Ru(dpp)RuL'(sup +4) units L = bpy or phen, to couple Fe(II) units to form (Fe(CN)4)2dpp(sup -4) and to couple the heterometallic system, (bpy)2RudppFe(CN)4. These systems show extensive metal-metal coupling through electrochemical studies, emission maxima that depend upon the M(dpp)M' linkage, and lifetimes in the 50 to 200 ns region in acetonitrile at room temperature. DOE

N87-14539# Pacific Northwest Labs., Richland, Wash.
OVERVIEW OF BIOMASS THERMOCHEMICAL LIQUEFACTION RESEARCH SPONSORED BY THE US DEPARTMENT OF ENERGY
D. J. Stevens May 1986 5 p Presented at the Intersociety Energy Conversion Engineering Conference, San Diego, Calif., 25 Aug. 1986
(Contract DE-AC06-76RL-01830)
(DE86-015058; PNL-SA-14023; CONF-860810-23) Avail: NTIS HC A02/MF A01

Biomass is an important energy resource at present and offers excellent potential for increased energy impact in the future. This potential energy impact is expected to be met in part by liquid fuels derived from biomass. Liquid fuels are more energy dense than biomass itself and more closely match existing end-use patterns. In this paper, research sponsored by the US Department of Energy's Biomass Energy Technology Division on the direct thermochemical conversion of biomass to liquid fuels is discussed. Both the conversion of biomass to biocrude oil and subsequent product upgrading to hydrocarbon-compatible fuels are addressed. DOE

N87-14540# Delphi Research, Inc., Albuquerque, N. Mex.
HYDROGEN PRODUCTION WITH THE ELECTROCATALYTIC OXIDATION SYSTEM Final Report, 30 Apr. 1985 - 31 Jul. 1986
P. M. Dhooge and L. A. Henson Jun. 1986 118 p Sponsored by New Mexico Research and Development Inst.
(PB86-223898; NMRDI-2-73-4633) Avail: NTIS HC A06/MF A01 CSCL 21D

A catalyzed, mediated electrochemical reaction to depolarize the anode of a hydrogen production cell was investigated. The reaction rates and activation energies for oxidation of wood chips, cattle manure and municipal sewage sludge by a number of catalyst/mediator combinations were investigated. Five combinations were chosen for extended testing in a laboratory-sale prototype reactor system, while measurements of current and potential levels, hydrogen production efficiencies, products of the biomass oxidations and catalyst/mediator solution stability were made. Results show that the process is practical and can be used in production of hydrogen from water at potentials of 1.0 volt or less. GRA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology.*

N87-14541*# National Aeronautics and Space Administration, Washington, D.C.
SPACE TECHNOLOGY IN BERLIN. VOLUME 1: IDEAS FOR THE ESTABLISHMENT OF AN INSTITUTE FOR SPACE PROCESSING TECHNOLOGY
Sep. 1986 24 p Transl. into ENGLISH of "Weltraumtechnologie

in Berlin. Band 1: Ideen zur Gruendung eines Institutes fuer Extraterrestrische Produktionstechniken" IN: Senator fuer Wissenschaft und Forschung (Berlin, West Germany, p 1-20 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-87994; NAS 1.15:87994) Avail: NTIS HC A02/MF A01 CSCL 84A

The past, present, and future status of space technology in Berlin is discussed, including raw material processing, transportation, energy, and information generation and distribution. How Berlin can contribute toward further advancement in this field, individually or in collaboration with international partners is indicated. Author

N87-14542# Freiburg Univ. (West Germany). Kristallographisches Inst.
GROWTH OF A SILICON SINGLE CRYSTAL BY THE FLOATING-ZONE TECHNIQUE UNDER MICRO-g CONDITIONS DURING SPACELAB 1 Final Report, Dec. 1984
Achim Eyer and Harald Leiste Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 99 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-004; ISSN-0170-1339; ETN-86-98283) Avail: NTIS HC A05/MF A01, Fachinformationszentrum, Karlruhe, West Germany DM 21

One hundred Si-crystals (P-doped, 0.03 Ohm/cm, dia =10mm, L=140mm), provided with a neck, were fabricated in the laboratory model of the Mirror Heating Facility according to specification. Flight, reference and spare samples were selected. During the SL-1 flight, two growth experiments were performed by the payload specialists in voice contact with the experimenter, who could observe a televised image of the molten zone. The samples were recrystallized by the floating zone technique starting at the lower end of the neck. Comparison of dopant inhomogeneities (striations) in the flight crystal and the reference crystal reveals no significant differences. Thermocapillary (Marangoni) flows in the melt are the cause of striations and not gravity driven flows. This is corroborated by a zoning experiment in a sounding rocket and experiments with coated zones on Earth. The behavior of the free liquid zone under microgravity was studied on video recordings of the flight experiments. ESA

N87-14543# Freiburg Univ. (West Germany). Kristallographisches Inst.
PREPARATION OF A SOLVENT ZONE CRYSTALLIZATION EXPERIMENT OF CADMIUM TELLURIDE DURING THE FIRST SPACELAB PROJECT (FSLP) SPACELAB MISSION Final Report, Sep. 1984
Rudolf Dian and Reinhard Schnoenholz Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 88 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-005; ISSN-0170-1339; ETN-86-98759) Avail: NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

The growth of CdTe single crystals by the traveling heater method in the Spacelab double and single ellipsoid mirror heating facilities was improved. At 800 C, zone heights of 60% of the crystal diameter and velocities of 3 to 10 mm/d, cylindrical crystals of 60 mm length and 10, 15, and 20 mm diameter were obtained. Crystal characterization comprized microscopic investigations, determination of the resistivity, and gamma ray detection. Etching reveals dislocations, grain boundaries and twins. High resistivity material (100 million Ohm/cm), suitable for gamma-detectors, can be obtained by compensation with chlorine. ESA

N87-14408# National Aerospace Lab., Amsterdam (Netherlands).
OBSERVATIONS ON BEHAVIOR OF LIQUID IN WEIGHTLESSNESS
J. P. B. Vreeburg *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 129-136 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14409# Vrije Universiteit, Brussels (Belgium). Dept. of Chem. Physics.
SURFACE TENSION MINIMUM AND MARANGONI CONVECTION
J. C. Legros, M. C. Limbourg-Fontaine, and G. Petre *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 137-143 Sponsored by SPPS, Fonds National de la Recherche Fondamentale Collective, La Loterie Nationale, Banque Nationale, Fonds National de la Recherche Scientifique, Fondation Univ. A et D Van Buren, and the Commission de la Recherche de l'Univ. Libre de Brussels, Belgium (For primary document see N87-14394 06-18)
(Grant NATO-916-83)
Avail: NTIS HC A10/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N87-14544# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TWO PHASE FLOWS IN MAJOR TECHNOLOGICAL HAZARDS, VOLUME 2
1986 368 p Lecture series held in Rhode-Saint-Genese, Belgium, 24-28 Mar. 1986
(VKI-LS-1986-03-Vol-2; ETN-87-98546) Avail: NTIS HC A16/MF A01

Discharges of saturated liquefied gases from pressure vessels; formation and dynamics of aerosols; transport of toxic material in aerosol phase; numerical modeling of aerosols; stratification phenomena, steam explosions, and associated hazards; thermohydraulics during venting of two-phase systems; and two-phase flow through safety devices and valves were discussed. For individual titles, see N87-14545 through N87-14552.

N87-14545# Koninklijke/Shell-Lab., Amsterdam (Netherlands).
DISCHARGES OF SATURATED LIQUEFIED GASES FROM PRESSURE VESSELS c34
H. E. A. vandenAkker *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 79 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

Vessel blowdowns in which a saturated liquid escapes from a pressure vessel via an aperture in the vessel wall or via a pipe are discussed. Vapor nucleation and flow phenomena in discharge pipes are considered. Experiments confirm observations that via an aperture such discharges take place in the form of a jet of superheated liquid. In short pipes, nonequilibrium phase transition phenomena dominate and affect type and rate of discharge: at low excess pressures superheated liquid is discharged, whereas at higher pressure incipient flashing starts restricting the rate of discharge. ESA

N87-14546# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Lab. de Physique et Metrologie des Aerosols.
FORMATION AND DYNAMICS OF AEROSOLS c34
D. Boulaud *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 27 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

The physical mechanisms occurring inside a fluid volume prior to aerosol formation are described. The gas to particle conversion and agglomeration processes are discussed. The general dynamic equation for aerosols covering all these phenomena is established. Its use and application are illustrated by examples of aersols produced by photochemical reactions and aerosols released by a sodium fire. ESA

N87-14547# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Lab. de Physique et Metrologie des Aerosols.
TRANSPORT OF TOXIC MATERIAL IN AEROSOL PHASE c34

D. Boulaud *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 26 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

The diffusion equation, friction coefficient, and influence of an external field in particle motion are discussed. The role of the fluid movement in particle transport is analyzed. Convective diffusion and inertial deposition are described. The deposition of aerosols in circular cross section pipes with steady flow established is considered. Use of computing methods to predict aerosol deposits is treated. ESA

N87-14548# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Centre d'Etudes Nucleaires.
NUMERICAL MODELING OF AEROSOLS c34
J. Gauvain and A. LHomme *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 27 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

The main formalism used for numerical modeling of aerosols is outlined. Predictions are compared with a sodium fire experiment with constant oxygen proportion. The suspended mass concentration of particles changing with time; evolution of the aerodynamic mean radius; kinetics of settled mass; and the suspended particles spectrum at the beginning and at the end of the fire are presented. ESA

N87-14549# California Univ., Santa Barbara. Dept. of Chemical and Nuclear Engineering.
STRATIFICATION PHENOMENA AND ASSOCIATED HAZARDS c73
T. G. Theofanus *In* Von Karman Inst. for Fluid Dynamics Tow Phase Flows in Major Technological Hazards, Volume 2 1986 48 p Sponsored by NRC (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

Examples of stratification-induced hazards in a variety of technological settings are discussed and a classification is suggested. A set of mechanistic, elementary processes, useful for comprehending the practical situations, is outlined. The Seveso accident, pressurized thermal shock of nuclear reactor vessels, and combustible gases in nuclear reactor containments are reviewed. ESA

N87-14550# California Univ., Santa Barbara. Dept. of Chemical and Nuclear Engineering.
STEAM EXPLOSIONS AND ASSOCIATED HAZARDS
T. G. Theofanus *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 36 p Sponsored by NRC (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

The different kinds of situation where steam explosions can occur (underwater volcanoes, metals and paper industry, liquefied gas, nuclear reactors) and well-known accidents involving steam explosions are discussed. A set of mechanistic elementary processes, useful for comprehending the key aspects of the steam explosion phenomenon and associated structural damage is outlined. A major steam explosion event in a nuclear reactor that is being subjected to a core-melt accident is assessed to illustrate the methodology, including quantification of uncertainties. ESA

N87-14551# Hoechst A.G., Frankfurt am Main (West Germany). Technishe Pruefung.
THERMOHYDRAULICS DURING VENTING OF TWO-PHASE SYSTEMS c34
L. Friedel *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 68 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

Illustrations for a lecture on the thermohydraulics of venting of two-place systems are presented. ESA

N87-14552# Hoechst A.G., Frankfurt am Main (West Germany). Technische Pruefung.
TWO-PHASE FLOW THROUGH SAFETY DEVICES AND VALVES
L. Friedel *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 54 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

The illustrations for a lecture on two-plase flow through safety devices and valves are presented. ESA

N87-14553*# National Aeronautics and Space Administration, Washington, D.C.
CABLES AND FIRE HAZARDS
C. Zanelli, S. Philbrick, and G. Beretta Oct. 1986 16 p Transl. into ENGLISH from "Cavi e Periocolo dIncendio" IN: LElettrotecnica (France), v. 61, no. 4, Apr. 1974 p 361-365 Presented at the 2nd Meeting of CIRED, International Congress of Electrical Distribution Networks, London, England, May 1973 Transl. by The Corporate Word, Inc., Pittsburgh, Pa. Original document was prepared by Pirelli Industries, S.p.A.., and by Pirelli General Cable Works, Ltd. (Contract NASw-4006)
(NASA-TM-88493; NAS 1.15:88493) Avail: NTIS HC A02/MF A01 CSCL 94O

Besides describing the experiments conducted to develop a nonflammable cable, this article discusses several considerations regarding other hazards which might result from cable fires, particularly the toxicity and opacity of the fumes emitted by the burning cable. In addition, this article examines the effects of using the Oxygen Index as a gauge of quality control during manufacture. Author

N87-14554# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
RESILIENT MODULUS OF FREEZE-THAW AFFECTED GRANULAR SOILS FOR PAVEMENT DESIGN AND EVALUATION. PART 4: FIELD VALIDATION TESTS AT ALBANY COUNTY AIRPORT Final Report
Thaddeus C. Johnson, Andrew Crowe, Mark Erickson, and David M. Cole Oct. 1986 146 p
(DA Proj. 4A7-62730-AT-42)
(DOT/FAA/PM-84/16,4; CRREL-86-13-Pt-4) Avail: NTIS HC A07/MF A01

Stress-deformation data for unbound base, subbase, and silty sand subgrade soils in two airfield pavements were obtained from in situ tests and laboratory tests. Surface deflections were measured in the in situ tests, with a falling-weight deflectometer, when the soils were frozen, thawed, and at various stages of recovery from thaw weakening. The measured deflections were used to judge the validity of procedures developed for laboratory triaxial tests to determine nonlinear resilient moduli of specimens in the frozen, thawed and recovering states. The validity of the nonlinear resilient moduli, expressed as functions of externally applied stress and moisture tension, was confirmed by using the expressions to calculate surface deflections that were found to compare well with deflections measured in the in situ tests. The tests on specimens at various stages of recovery are especially significant because they show a strong dependence of the resilient modulus on moisture tension, leading to the conclusion that predictions or in situ measurements of moisture tension can be used to evaluate expected seasonal variation in the resilient modulus of granular soils. Author

N87-14555# Kieserling und Albrecht Werkzeugmaschinenfabrik, Solingen (West Germany). Entwicklungs- und Versuchsabteilung.
DEVELOPMENT OF A COPY-PEELING MACHINE FOR MACHINING THE SURFACE OF HOT ROLLED SQUARE BILLETS Final Report, Mar. 1982
Rolf-Eckart Koch, Ralf Fangmeier, and Bernhard Seppelt Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 79 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-HA-86-004; ISSN-0171-7618; ETN-86-98284) Avail:

NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 16.50

A copy-peeling system to replace the high-pressure grinding method, especially for stainless steel qualities, was developed. The copy-peeling process for square billets was accomplished on an existing planing machine with special test attachments as well as on a specially developed copy-peeling machine. The attainable material removals and the tool life reached during the tests with stainless steel are not sufficient to offer an economic and technically advanced alternative to high-pressure grinding. The advantages of copy peeling with respect to safety and health of the operational personnel are obvious. However, it cannot be expected that this process will be applied extensively. ESA

N87-14556# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.

THE EFFECT OF PROCESS PARAMETERS ON THE INTERNAL QUALITY OF AN ALUMINUM DIE CASTING Thesis [INVLOED VAN PROCESVARIABELEN OP DE INTERNE KWALITEIT VAN EEN ALUMINIUM SPUITGIETSTUK]

M. C. A. J. deWit Jan. 1986 90 p

(ETN-86-98703) Avail: NTIS HC A05/MF A01

The influence of process parameters on the porosity of an aluminum die casting was investigated. Two types of die one of which had an interchangeable gate and two alloys, AlSi8Cu3 and AlSi7, were used. During the solidification phase of a die casting, air entrapment can occur; the air remains in the die casting under high pressure after solidification. The Rayleigh number which contains the velocity in the gate, the gate diameter, and the liquid metal surface tension, determines the air entrapment. It appears that there are two types of filling: solid front filling at low velocities, and standard spray filling at high velocities. With the former type, the castings contain no air, but the shrinkage is concentrated in big holes; with the latter type the castings contain much air, and the shrinkage is distributed over fine holes. The first phase velocity has no significant influence on the porosity; a decrease of the third phase velocity increases the porosity. Variations of the changeover point between the first and second phase have little influence. ESA

N87-14557# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.

THE CONTINUOUS PRODUCTION OF STIR CAST MATERIAL Thesis [DE CONTINUE PRODUKTIE VAN ROERGIETMATERIAAL]

A. Hamoen Jun. 1986 85 p In DUTCH; ENGLISH summary

(ETN-87-98701) Avail: NTIS HC A05/MF A01

The production of AlSi8 extrusion billets using a semicontinuous caster is described. The continuous casting process and the process parameters are outlined. The mathematical model, developed to calculate the temperature distribution within the billet during casting as a function of the process parameters, is explained. Quality control focussed on inversion segregation which causes the formation of a surface layer with a different structure and composition, imposing peeling of billets. Product development focussed on the production of stir-cast material of the same AlSi8 alloy. The use of AlSi8 as a wrought alloy by modification of the structure by stirring is discussed. ESA

N87-14558# Ecole Nationale Superieure de Techniques Avancees, Paris (France). Lab. de Mecanique et Energetique.

[ACTIVITIES REPORT OF THE LABORATORY OF MECHANICS AND ENERGY STUDIES] Annual Report, 1985 [RAPPORT D'ACTIVITE DU LABORATOIRE DE MECANIQUE ET ENERGETIQUE 1985]

1985 50 p In FRENCH Original contains color illustrations

(ETN-87-98577) Avail: NTIS HC A03/MF A01

Research in combustion analysis, fluid mechanics, ship design, servomechanisms, numerical analysis, structural analysis, composite materials, and material tests is summarized. ESA

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N87-14559* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DOUBLE REFERENCE PULSED PHASE LOCKED LOOP Patent

Joseph S. Heyman 25 Nov. 1986 6 p Filed 7 Mar. 1985 Supersedes N85-21441 (23 - 12, p 1824)

(NASA-Case-LAR-13310-1; US-Patent-4,624,142; US-Patent-Appl-SN-709257; US-Patent-Class-73-597; US-Patent-Class-73-615; US-Patent-Class-367-99; US-Patent-Class-356-5) Avail: US Patent and Trademark Office CSCL 20N

A double reference pulse phase locked loop is described which measures the phase shift between tone burst signals initially derived from the same periodic signal source (voltage controlled oscillator) and delayed by different amounts because of two different paths. A first path is from the transducer to the surface of a sample and back. A second path is from the transducer to the opposite surface and back. A first pulse phase locked loop including a phase detector and a phase shifter forces the tone burst signal delayed by the second path in phase quadrature with the periodic signal source. A second pulse phase locked loop including a second phase detector forces the tone burst signals delayed by the first path into phase quadrature with the phase shifted periodic signal source. Official Gazette of the U.S. Patent and Trademark Office

N87-14560# European Space Agency, Paris (France).

FADE COUNTERMEASURES FOR SATELLITE COMMUNICATIONS

Norman Longdon, comp. May 1986 53 p

(ESA-STM-235; ISSN-0379-4075; ETN-86-98251) Avail: NTIS HC A04/MF A01

Alleviation of fading effects in radiopaths by fade-spreading; adaptive transmission rate and variable redundancy systems as a fade countermeasure; adaptive TDMA as a means of trading power against bandwidth; uplink power control of satellite Earth stations as a fade countermeasure of 20/30 GHz communication systems; and development of the design concept for a variable rate system for the 30/20 GHz Olympus trial are discussed. For individual titles, see N87-14561 through N87-14565.

N87-14561# European Space Agency, Paris (France).

ALLEVIATION OF FADING EFFECTS IN RADIOPATHS BY FADE-SPREADING

C. D. Hughes *In its* Fade Countermeasures for Satellite Communications May 1986 p 3-9 (For primary document see N87-14560 06-32)

Avail: NTIS HC A04/MF A01

A fade countermeasure for communication satellite radio transmission is proposed. The technique employs spectrum spreading with a fixed chip rate but a variable data rate throughput. The spreading factor is thus a variable which can be adjusted according to the fading conditions. In deep fades a high spreading factor can be used and hence the full signal to noise ratio improvement available from the spread spectrum technique can be obtained. In clear weather a spreading factor close to unity can be used. The information throughput is then at or near the chip rate and there is no signal to noise ratio improvement. The technique is adaptive and does not require designers to build in very large margins for events which occur infrequently. The adjustable hardware elements in the transmission chain are confined to a simple variable bandwidth low pass filter at the receive end of the system. Within the transmission and reception equipment the system requires a constant transmission bandwidth

and power requirement. It is ideally suited therefore to satellite multiple access systems. ESA

N87-14562# European Space Agency, Paris (France).
ADAPTIVE TRANSMISSION RATE AND VARIABLE REDUNDANCY SYSTEMS AS A FADE COUNTERMEASURE
O. Koudelka *In* ESA Fade Countermeasures for Satellite Communications May 1986 p 11-13 (For primary document see N87-14560 06-32)
Avail: NTIS HC A04/MF A01

Countermeasures against fade in satellite links are discussed. Adaptive bit rate modems which vary the transmission rate to adapt it to the requirements of the traffic and channel quality; adaptive code rate systems in which the redundancy overhead and hence the error correction capability can be selected according to channel quality; and a combination of variable bit rate and code rate systems are described. ESA

N87-14563# European Space Agency, Paris (France).
ADAPTIVE TDMA AS A MEANS OF TRADING POWER AGAINST BANDWIDTH
S. K. Barton *In its* Fade Countermeasures for Satellite Communications May 1986 p 15-17 (For primary document see N87-14560 06-32)
Avail: NTIS HC A04/MF A01

The use of variable rate signalling in satellite communication links is introduced. The technique is illustrated for a simplified network of 10 ground stations each of which is required to send 100 kbit/sec of data with 99.5% availability. It is shown that while a variable rate TDMA system occupies 2.4 times the bandwidth of a fixed rate system, it operates with a 1dB margin instead of 10db, giving a net saving of 5dB in power. The best choice of coding rates to give nearly equal small steps of link margin is examined for Reed-Solomon codes. ESA

N87-14564# European Space Agency, Paris (France).
UPLINK POWER CONTROL OF SATELLITE EARTH STATIONS AS A FADE-COUNTERMEASURE OF 20/30 GHz COMMUNICATION SYSTEMS
J. Hoerle *In its* Fade Countermeasures for Satellite Communications May 1986 p 19-28 (For primary document see N87-14560 06-32)
Avail: NTIS HC A04/MF A01

It is shown that 20/30 GHz satellite link performance can be significantly improved with uplink power control systems of the Earth station without increasing the maximum available EIRP. Other advantages include unchanged transmission characteristics, i.e., no change in bandwidth or data rate; constant carrier to interference ratio within the dynamic range of the uplink power control; suitability for multipoint to multipoint configurations with Earth stations in different radio climatic zones; and possibility to combine with other type of fade countermeasures. If uplink power control is combined with other fade countermeasures, the uplink power control should basically be applied first when a fade occurs. Link improvement achieved by uplink power control is limited by the maximum available Earth station EIRP, the maximum gain of the satellite transponder, and the link margin for downlink fades. ESA

N87-14565# Department of Communications, Ottawa (Ontario). Communications Research Center.
DEVELOPMENT OF THE DESIGN CONCEPT FOR A VARIABLE RATE SYSTEM FOR THE 30/20 GHz OLYMPUS TRIAL
J. D. Palmer, E. K. Tsang, and N. G. Davies *In its* Fade Countermeasures for Satellite Communications May 1986 p 29-48 (For primary document see N87-14560 06-32)
Avail: NTIS HC A04/MF A01

The market for Olympus satellite Ka band services, and obstacles to Ka band operation are discussed. Tests of communication between stations representative of low cost user terminals are outlined. Bit error rate objective is better than 1 in 10 million, with 99.8% availability at the T1 rate. Complete outage is expected to occur for less than 0.05% of the year. The system will experience high attenuation of the EHF signals during rainstorms. Since the provision of high operating margins would render the user stations too expensive, with large antennas which would be unsuitable for installation on user premises, the system will be designed to operate at lower bit rates during periods of high attenuation. The bit rate reduction will occur in 3dB steps down to a minimum of 56 Kbps. ESA

N87-14566 Royal Aircraft Establishment, Farnborough (England).
A PRACTICAL GUIDE TO THE DESIGN OF RHOMBIC AERIALS
J. N. Tyler Apr. 1985 39 p
(RAE-TM-RAD-NAV-266; BR98240; ETN-86-98377) Avail: NTIS HC A03/MF A01

Basic principles of the rhombic aerial are explained and design charts are presented. These, compiled using two simple computer programs, offer a considerable time saving in design. Examples of aerials designed using the charts are given, together with polar diagrams of their theoretical performance. ESA

N87-14567*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
RADAR SCENE GENERATION FOR TACTICAL DECISION AIDS Semiannual Report, 15 Apr. - 14 Oct. 1986
J. A. Kong 1986 7 p
(Grant NAG5-769)
(NASA-CR-180027; NAS 1.26:180027) Avail: NTIS HC A02/MF A01 CSCL 17I

The Mueller matrix and polarization covariance matrix for polarimetric radar systems was studied. The clutter was modeled by a layer of random permittivity, described by a three-dimensional correlation function, with variance, and horizontal and vertical correlation lengths. This model was applied, using the wave theory with Born approximations carried to the second order, to find the backscattering elements of the polarimetric matrices. Theoretical predictions are matched with experimental data for vegetation fields. The strong fluctuation theory was used to derive the backscattering cross sections. A two-layer anisotropic random medium model was developed for the active and passive microwave remote sensing of ice fields. A three-layer random medium model was adopted to study the volume scattering effects for the active and passive microwave remote sensing of snow-covered ice fields. B.G.

N87-14568*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
HIGH SPATIAL RESOLUTION PASSIVE MICROWAVE SOUNDING SYSTEMS Progress Report, 1 Feb. - 30 Jul. 1986
David H. Staelin, Philip W. Rosenkranz, Pierino G. Bonanni, and Albin W. Gasiewski 31 Dec. 1986 7 p
(Grant NAG5-10)
(NASA-CR-180025; NAS 1.26:180025) Avail: NTIS HC A02/MF A01 CSCL 20N

Two extensive series of flights aboard the ER-2 aircraft were conducted with the MIT 118 GHz imaging spectrometer together with a 53.6 GHz nadir channel and a TV camera record of the mission. Other microwave sensors, including a 183 GHz imaging spectrometer were flown simultaneously by other research groups. Work also continued on evaluating the impact of high-resolution passive microwave soundings upon numerical weather prediction models. B.G.

N87-14569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DESIGN CONCEPT FOR AN MMIC MICROSTRIP PHASED ARRAY
Richard Q. Lee, Jerry Smetana, and Roberto Acosta 1986 13 p Presented at the 1986 Antenna Applications Symposium, Monticello, Ill., 17-19 Sep. 1986; sponsored by Illinois Univ. and RADC
(NASA-TM-88834; E-3213; NAS 1.15:88834) Avail: NTIS HC A02/MF A01 CSCL 20N

A conceptual design for a microstrip phased array with monolithic microwave integrated circuit (MMIC) amplitude and phase controls is described. The MMIC devices used are 20 GHz

variable power amplifiers and variable phase shifters recently developed by NASA contractors for applications in future Ka band advanced satellite communication antenna systems. The proposed design concept is for a general NxN element array of rectangular lattice geometry. Subarray excitation is incorporated in the MMIC phased array design to reduce the complexity of the beam forming network and the number of MMIC components required. The proposed design concept takes into consideration the RF characteristics and actual phyical dimensions of the MMIC devices. Also, solutions to spatial constraints and interconnections associated with currently available packaging designs are discussed. Finally, the design of the microstrip radiating elements and their radiation characteristics are examined. Author

N87-14570# Naval Postgraduate School, Monterey, Calif.
A USER-ORIENTED PERFORMANCE INDEX FOR PACKET SWITCHED NETWORKS M.S. Thesis
Mark E. Speck Mar. 1986 77 p
(AD-A168903) Avail: NTIS HC A05/MF A01 CSCL 17/2

As packet switched networks become more widely used, there will be a need to characterize network performance with an index that defines how well the network can meet the user's needs. This thesis explains present and future measures of network performance, some of which are user-oriented, and how they can be useful. Dividing users into groups based on user needs, a model of a composite, performance index is developed. The usefulness of this index, if provides on a real-time basis, is then explored and substantiated. Author (GRA)

N87-14571# Naval Research Lab., Washington, D. C.
RENORMALIZATION OF AN INVERSE SCATTERING THEORY FOR GAUSSIAN DIELECTRIC PROFILES Interim Report
A. K. Jordan and H. D. Ladouceur 10 Jun. 1986 12 p
(AD-A169328; NRL-MR-5795) Avail: NTIS HC A02/MF A01 CSCL 20/14

An inversion method is developed for reconstructing the average permittivity profiles of inhomogeneous dielectric slabs from reflection coefficient data. Renormalized solutions are obtained for an inverse scattering problem that are equivalent to the second order regular perturbation approximations. Solutions with increased radii of convergence are obtained. Numerical examples are demonstrated for simulated scattering data from average dielectric profiles that are Gaussian functions. GRA

N87-14572# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
NONLINEAR WAVE PROPAGATION STUDY Final Report, 1 May 1983 - 30 Oct. 1985
J. R. Bulau and B. R. Tittmann Apr. 1986 52 p
(Contract F49620-83-C-0065)
(AD-A170201; SC5361-10FR; AFOSR-86-0497TR) Avail: NTIS HC A04/MF A01 CSCL 08/7

We have examined some of the methods available for use in the laboratory to measure the inelastic attenuation of seismic waves in rocks. We conclude that the forced swept resonance technique is best suited for measuring the Q of linear anelastic materials, and for defining the transition amplitude from linear anelastic behavior to nonlinear behavior. For evaluating losses in materials at high amplitudes, which exceed the elastic limit, the best technique requires simultaneous measurements of the time functions of stress and strain under conditions that simulate seismic loading as closely as possible. GRA

N87-14573# Naval Test Pilot School, Patuxent River, Md.
DERIVATION OF THE RADAR RANGE EQUATION FOR A PULSE-DOPPLER RADAR WITH RANGE AND VELOCITY GATING AND COHERENT AND NONCOHERENT PULSE INTEGRATION
George Masters 27 Jun. 1986 15 p
(AD-A170354; USNTPS-TM-86-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

The radar range equation is employed in test planning to predict the probability of target detection for a given set of test conditions (target parameters, range, velocity, aspect angle, radar parameters, etc.). This technical memorandum documents the detailed development of the radar range equation including the effects of range gating, velocity gating, and both predetection and postdetection pulse integration. Author (GRA)

N87-14574# SACLANT ASW Research Center, La Spezia (Italy).
AUTOMATIC PICTURE TRANSMISSION RECEIVERS FOR WEATHER SATELLITE IMAGES. A BRIEF INTRODUCTION AND SURVEY OF SOME COMMERCIALLY-AVAILABLE EQUIPMENT
Peter J. Minnett Jun. 1986 14 p
(AD-A170359; SACLANTCEN-SM-186) Avail: NTIS HC A02/MF A01 CSCL 17/2

The Automatic Picture Transmission (APT) signal is broadcast from seveal polar-orbiting weather satellites and provides a means of generating images of meteorological and oceanic features in real-time on relatively inexpensive equipment. Following a brief description of the APT signal content, and a discussion of the requirements of the APT receiving station, a number of commercially-available systems are described. A list of manufacturers of APT receiving stations is appended (but it is not intended to be exhaustive). Author (GRA)

N87-14575# Department of the Navy, Washington, D. C.
ELECTRIC WAVE DEVICE AND METHOD FOR EFFICIENT EXCITATION OF AN DIELECTRIC ROD Patent Application
Albert D. Krall and James P. Coughlin, inventors (to Navy) Filed 1 May 1986 17 p
(AD-D012430; US-Patent-Appl-SN-859109) Avail: NTIS HC A02/MF A01 CSCL 09/5

This patent application describes an electric wave operating device for efficiently coupling electromagnetic energy from a waveguide into a dielectric element or vice versa. A waveguide horn portion is chosen for radiating in the primary HE11 mode and designed to have a predetermined HE11 mode farfield radiation pattern. A dielectric member is securely disposed with one end in the plane of the aperture of the waveguide horn with the dielectric member having a predetermined HE11 mode farfield radiation pattern substantially equal to the farfield radiation pattern of the horn. GRA

N87-14576# Department of the Air Force, Washington, D.C.
SPACECRAFT SUBSYSTEM SUPPORT STRUCTURE Patent Application
Mark A. Witten, inventor (to Air Force) Filed 28 May 1986 31 p
(AD-D012437; US-Patent-Appl-SN-867652) Avail: NTIS HC A03/MF A01 CSCL 22/2

A structural system is used to hold a laser communications subsystem having a gimballed telescope mounted on a truss system. Optical equipment requiring high tolerances is mounted onto an equipment support assembly that is mounted within the truss system for the gimballed telescope. This assembly is mounted by means of frame members and truss tubes. Author (GRA)

N87-14577# North Texas State Univ., Denton. Dept. of Mathematics.
THE CONSTRUCTION OF LOW NOISE OPTICAL CORRELATION FILTERS AND THEIR APPLICATION TO TARGET IDENTIFICATION PROBLEMS Final Technical Report, 1 Jun. - 31 Dec. 1985
Robert R. Kallman Jul. 1986 49 p
(Contract F30602-81-C-0206)
(AD-A170629; AD-E801330; AFATL-TR-86-20) Avail: NTIS HC A03/MF A01 CSCL 17/8

Synthetic discriminant functions (SDF's) for optical matched filters have potential use for pattern recognition. However, these filters have been plagued with low signal-to-noise ratio (SNR); i.e., these filters have no trouble correlating very well with true targets, but very often give high (even major) correlations with false targets. In fact, numerical experiments by the author and others on realistic data sets show that the standard recipe for manufacturing SDF's gives filters with an SNR close to 1.00, even on a training set of imagery which has been edge-enhanced and energy-normalized.

This document gives a new recipe for manufacturing SDG's when applied to the data set of images. When tested against a randomly generated sequence of true targets in very cluttered backgrounds (true tanks in a junkyard of tank parts), this new filter so far has invariably picked out true target, whereas the filter manufactured with the standard recipe has given the major correlation to false targets approximately 25 percent of the time. GRA

N87-14578# Panametrics, Inc., Waltham, Mass.
ABSORPTION AND SCATTERING BY CONDUCTIVE FIBERS: BASIC THEORY AND COMPARISON WITH ASYMPTOTIC RESULTS Annual Report, May 1984 - Sep. 1985
N. E. Pedersen, J. C. Pedersen, and P. C. Waterman 29 Oct. 1985 68 p
(Contract F49620-84-C-0045)
(AD-A170771; AFOSR-86-0516TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

A theory based on the variational method, along with associated computer codes, has been developed for analyzing the electromagnetic scattering and absorption from thin conductive fibers of arbitrary size, conductivity and orientation. Extensions and refinements of this theory have now been completed and programmed. A summary is given of the basic equations used in the variational computation for arbitrary fibers. The quasistatic model appropriate at long wavelengths is then derived, followed by the infinite cylinder computation which should be accurate for wavelengths short compared with cylinder length. In order that the computations may be extended into the infrared and visible regimes, it is necessary to incorporate the optical properties of the fibers. Curved fibers are considered in this report. An exact integral equation is derived for the general case, and some approximate results are then given for special fibers. Also discussed are the optimum conditions for target obscuration by a cloud of particles from a mass efficiency standpoint. Particle optimization studies are performed under varying requirements on absorption, reflection, and transparency of the particle cloud. GRA

N87-14579# California Univ., Los Angeles.
PERFORMANCE EVALUATION AND CONTROL OF DISTRIBUTED COMPUTER COMMUNICATION NETWORKS Annual Report
Izhak Rubin and Mario Gerla Sep. 1985 42 p
(Grant AF-AFOSR-0304-82)
(AD-A170810; UCLA-ENG-85-30; AFOSR-86-0560TR) Avail: NTIS HC A03/MF A01 CSCL 17/2

During the 1982 to 1985 performance-period under this AFOSR Grant, we have carried out research investigations and obtained many significant results, of both theoretical and practical importance. A large multitude of computer communication network architectures, models and control schemes have been developed, analyzed and evaluated. GRA

N87-14580# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
COMMAND-AND-CONTROL (C2) THEORY: A CHALLENGE TO CONTROL SCIENCE
Michael Athans Jul. 1986 20 p Prepared in cooperation with Alphatech, Inc., Burlington, Mass.
(Contracts N00014-77-C-0532; N00014-84-K-0519)
(AD-A171716; LIDS-P-1584) Avail: NTIS HC A02/MF A01 CSCL 17/2

The basic premise of this position paper is that the field of military Command-and-Control (C2) systems offers challenging basic research opportunities to researchers in the control sciences and systems engineering disciplines. In point of fact, the analysis and design of complex, survivable, and responsive C2 systems requires novel advances in the area of distributed dynamic decision-making under uncertainty. As a consequence, control scientists and engineers are uniquely qualified to extend their technologies to meet the multidisciplinary challenges posed by C2 systems and to advance the state of the art in the development of a relevant C2 theory. The author strongly believes that the methodological, theoretical, algorithmic, and architectural questions which arise in the context of military C2 systems are generic and quite similar to those needed to improve the reliable performance of many other civilian C2 systems, such as air traffic control, automated transportation systems, manufacturing systems, nuclear reactor complexes, etc. GRA

N87-14581# Department of the Army, Washington, D. C.
A LOG - PERIODIC HF ANTENNA SYSTEM Patent Application
Donn V. Campbell, Palemon W. Dubowicz, Bernard Feigenbaum, and Kenneth Loffer, inventors (to Army) Filed 26 Sep. 1986 63 p
(AD-D012527; US-Patent-Appl-SN-903627) Avail: NTIS HC A04/MF A01 CSCL 09/5

A plurality of dual feed half square wave antenna elements (each of U-shaped configuration) are arranged in a log-periodic structure. The antenna elements are feed at the current loops; i.e., at the corners of the U-shaped antenna elements. A dual inphase feed produces vertical polarization signals of low angle radiation, and a dual antiphase feed produces horizontal polarization signals of high angle radiation. GRA

N87-14582# Lawrence Livermore National Lab., Calif.
HIGH BANDWIDTH ANALOG APPLICATIONS OF PHOTONICS: PRESENT CAPABILITIES AND FUTURE POSSIBILITIES
F. Roeske 15 Aug. 1986 10 p Presented at the SPIE Fiber LASE 86, Cambridge, Mass., 14 Sep. 1986
(Contract W-7405-eng-48)
(DE86-014999; UCRL-95084; CONF-8609127-2) Avail: NTIS HC A02/MF A01

Experimenters involved in measuring single-shot, fast-transient phenomena are fast turning toward photonics to meet their experimental needs. Photonics is the technology of generating and using light in detection, diagnostics, communications, and information processing systems. This technology includes light generation, transmission, deflection, amplification, detection, and recording and includes areas of lasers and other light sources, fiber optics, electro-optical instrumentation, and optical components and instrumentation. Photonics systems offer immense advantages and possibilities over systems that use electrical signals. The advantages realized by photonics systems include increased data quality (in terms of bandwidth, resolution, reliability, and often accuracy and precision), increased data quantity, and economic and operational benefits. Single-shot, fast-transient analog measurement techniques introduce some special considerations and challenges for the experimenter that are not encountered in telecommunication applications of photonics. This overview explores some of these issues with emphasis placed on phottonic sensors and data recorders. A sampling of photonics diagnostic systems is presented along with a discussion of future possibilities and challenges facing the experimenter. This exciting new field is in its infancy, and many of the diagnostic techniques presented are still evolving into yet more powerful tools for the experimenter. Single-shot, fast-transient analog photonics diagnostic techniques have experienced an almost exponential growth over the past few years and are expected to have a major impact on governmental, industrial, and academic communities involved with such measurements. DOE

N87-14583# Sandia National Labs., Albuquerque, N. Mex. Electromagnetic Applications Div.
CALIBRATION OF AN ELECTROOPTICAL POST FOR INTENSE MICROWAVE DETECTION IN A RECTANGULAR WAVEGUIDE
C. N. Vittitoe Aug. 1986 18 p
(Contract DE-AC04-76DP-00789)
(DE86-015573; SAND-86-2064) Avail: NTIS HC A02/MF A01

Finite-difference analysis is used to develop calibration curves relating the propagating electric field and power density to the intensity of a laser beam traveling through an electrooptical post located within a 66- by 33-mm waveguide. TE(sub 10) mode microwave propagation is assumed. Frequencies from 3.41 to 3 GHz change the calibration only slightly. Variations in electrooptical material and laser wavelength can easily alter the calibrations

by a factor of 2. Transverse electric field variations across the post are less than or equal to 15% of the center value. Chosen parameters are appropriate to detect power densities in the range 0.2 to 7 MW/sq m. DOE

N87-14584# Centre National d'Etudes Spatiales, Toulouse (France).
OPTICAL INTERSATELLITE LINKS. PERFORMANCE COMPARISON FOR ON-OFF KEYING AND M-PPM POSITION MODULATION [LIAISONS OPTIQUES INTERSATELLITE. COMPARAISON DES PERFORMANCES DES FORMATS DE MODULATION NRZ ET M-PPM]
L. Frecon 30 Aug. 1985 23 p In FRENCH; ENGLISH summary
(CNES-CT/DRT/TIT/TR-154-T; ETN-86-98416) Avail: NTIS HC A02/MF A01

An optical link formed by a laser diode transmitter and an avalanche photodiode receiver is studied, determining the output signal statistics and the bit error rate for a simple (OOK) and a more complex modulation format. It is shown that 4-PPM and 8-PPM allow a gain of 1.8 and 2.7 dB, respectively at a 125 Mb/sec transmission rate. ESA

N87-14585# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
DEVELOPMENT OF TRANSMISSION FACILITIES FOR ELECTRONIC MEDIA IN THE NETHERLANDS
J. C. Arnbak Feb. 1986 38 p Partly in ENGLISH and DUTCH
(EUT-86-E-158; ISBN-90-6144-158-7; ISSN-0167-9708; ETN-86-98714) Avail: NTIS HC A03/MF A01

Technical developments of narrowband, wideband, satellite, and integrated transmission facilities for communications in the Netherlands are reviewed. It is postulated that the pace of the developments will continue to be determined more by political, cultural, and socioeconomic forces than by the revolution of information technology. Upgrading of the relatively widespread public communication facilities, both central antenna television and PTT networks, will be an evolutionary matter in the Dutch environment. ESA

N87-14586# Ecole Nationale Superieure des Telecommunications, Paris (France).
MODELING OF TELECOMMUNICATION SYSTEMS OPERATED WITH ADVANCED CAPACITY RESERVATION Ph.D. Thesis [MODELISATION DE SYSTEMES DE TELECOMMUNICATIONS FONCTIONNANT AVEC RESERVATION]
Ke-Qiang Liao 23 Jun. 1986 156 p In FRENCH; ENGLISH summary
(ENST-86E006; ISSN-0751-1353; ETN-86-98585) Avail: NTIS HC A08/MF A01

The principle characteristics of telecommunication reservation systems are highlighted and the parameters to be taken into consideration in their design are identified. Models to design systems which support the reservation traffic with a specified grade of service are discussed. In the case of a videoconferencing network, the number of channels required to carry the offered traffic under a number of hypothesis are established. ESA

N87-14587# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
DESIGN OF FILTERS FOR THE VERTICAL SUBSAMPLING OF COLOR DIFFERENCE SIGNALS AT HALF THE SAMPLING RATE
Klaus Merzenich Mar. 1986 29 p In GERMAN; ENGLISH summary
(FI-447-TB-19; ETN-86-98739) Avail: NTIS HC A03/MF A01

The distortions due to the nonideal filter characteristics in the vertical subsampling of the color difference signals of television pictures were examined. Systems reducing the sampling rate of a signal for transmission use prefilters before reducing the sampling rate, in order to restrict the transmission band to the limit postulated by the sampling theorem. At the decoder, the source signal is restored by postfiltering, after increasing the sampling rate to its original value. A cost effective combination of pre and postfilters which causes no perceptible loss of quality is presented. ESA

N87-14588# Research Inst. of National Defence, Linkoeping (Sweden).
DETECTION AND REPRESENTATION OF PLANAR SURFACES IN THREE DIMENSIONAL RANGE IMAGES
Lars Linmarker, Dan Sundstroem, and Sten Nyberg Jun. 1986 77 p In SWEDISH; ENGLISH summary
(FOA-C-30427-E1; ISSN-0347-3708; ETN-87-98561) Avail: NTIS HC A05/MF A01; Research Inst. of National Defence, Stockholm, Sweden KR 50

A range image generator, using a ring operator, produced an image representation for different simulated range images. The method detects all analyzed surfaces, although lack of accuracy is noted especially for noisy images. The method failed, totally or partially, for images with a false threshold of the control of the regional increase, and a false threshold for the image cleaning out. ESA

N87-14589# IFC Research, Claygate (England).
STUDY OF INFORMATION DISSEMINATION BY SATELLITE, VOLUME 1 Final Report
S. Connell, Brian G. Champness, B. Stapley, and R. Winsbury Paris, France ESA May 1985 123 p
(Contract ESA-5820/84-NL-DG)
(ESA-CR(P)-2171-Vol-1; ETN-87-98645-Vol-1) Avail: NTIS HC A06/MF A01

Western European demand for satellite information dissemination in the late 1990's was assessed. The major market opportunity lies in intra-organizational video communications. Broadcast satellites could be used to facilitate dispersal of newspaper printing sites and the development of regionalized or local editions. Examples would include the publication of editions of north European newspapers in Mediterranean holiday resorts. Data broadcasting services could use VBI or full channel teletext or other formats. The most promising area for data dissemination by satellite is the aggregation of a number of services which are themselves small, but in total could generate substantial demand. Examples of such services include dissemination of private company data to dispersed branches (pricing, stock levels, etc.). ESA

N87-14590# European Space Agency, Paris (France).
DEVELOPMENT OF A LINEAR BACKFIRE ANTENNA FOR AN AIRBORNE L-BAND SCATTEROMETER
Helmut Haerter and Bernd Mayr Jun. 1986 16 p Original language document was announced as N86-28307
(ESA-TT-986; DFVLR-Mitt-85-15; ETN-87-98828) Avail: NTIS HC A02/MF A01; original German version available from DFVLR, Cologne, West Germany DM 9.50

A short backfire antenna with four feeding elements was developed for airborne applications. The specifications and the design of the antenna are presented. The technical performance and the sizing of the antenna are described. ESA

N87-14591# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung HF-Verfahren.
ERROR ANALYSIS OF SAR HARDWARE
Joao Roberto Moreira May 1986 81 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-26; ISSN-0171-1342; ETN-87-98855) Avail: NTIS HC A05/MF A01; DFVLR, Cologne, West Germany DM 26.50

For the error analysis of radar flash A/D converters a computer aided measurement procedure which evaluates their dynamic characteristics was designed. Results like the transfer function, signal-to-noise ratio, jitter, linearity errors, and dispersion of two 100-MHz A/D-converters were obtained. This measurement principle permits the calibration of the front-end and the video section of the SAR, where the A/D-converters are considered as a measuring instrument. ESA

N87-14592# Max-Planck-Inst. fuer Plasmaphysik, Garching (West Germany).
ANTENNA OPTIMIZATION FOR ALFVEN WAVE HEATING
Satish Puri Jun. 1986 37 p
(IPP-4/228; ETN-87-98880) Avail: NTIS HC A03/MF A01

Antenna optimization studies for radio-frequency coupling to Alfven waves were carried out using a self-consistent, three-dimensional, fully-analytic, Faraday-shielded, periodic-loop-antenna model. It is possible to obtain an experimentally acceptable loading of 1 Ohm with Q factor = 20 by locating the singular Alfven layer at two-thirds the plasma radius, if the adjacent antenna separation along the toroidal direction is of the order of the plasma radius. This implies using a toroidal wave number = 8, for the ASDEX plasma upgrade case. By scaling the linear dimensions of the ASDEX upgrade, it is shown that Alfven-wave heating continues to be an attractive alternative even for plasmas of thermonuclear dimensions. Due to the changing plasma conditions during the radio-frequency heating phase, dynamic impedance tracking may become necessary. Methods for maintaining an efficient coupling under these conditions through the phase control of a dense-cluster-array antenna, resembling the lower-hybrid grill coupler, are suggested. ESA

N87-14593# European Space Agency, Paris (France).
SCATTERING BY COMPLICATED STRUCTURES: CALCULATION OF THE RADAR PROPERTIES OF METALLIC TARGETS BY MEANS OF PHYSICAL OPTICS
Dieter Klement Jan. 1986 55 p Original language document was announced as N86-10981
(ESA-TT-946; DFVLR-FB-85-22; ETN-87-98881) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 19.50

Theory and computer program for the determination of the radar cross section of metallic targets are described. The geometry of complicated targets is represented by plane quadrangles. The calculation of the radar cross section is carried out by the method of physical optics. Computer results of simple targets are compared with rigorous solutions, approximations, and measurements. The influence of surface shaping is demonstrated. ESA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N87-14594* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF EXAMINING MICROCIRCUIT PATTERNS Patent
Stefan F. Suszko, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena) Issued 18 Nov. 1986 10 p Filed 13 Oct. 1983 Supersedes N85-20250 (23 - 11, p 1628) Sponsored by NASA
(NASA-Case-NPO-16299-1; US-Patent-4,623,255;
US-Patent-Appl-SN-541526; US-Patent-Class-356-389) Avail: US Patent and Trademark Office CSCL 09C

Examination of microstructures of LSI and VLSI devices is facilitated by employing a method in which the device is photographed through a darkfield illumination optical microscope and the resulting negative subjected to inverse processing to form a positive on a photographic film. The film is then developed to form photographic prints or transparencies which clearly illustrate the structure of the device. The entire structure of a device may be examined by alternately photographing the device and selectively etching layers of the device in order to expose underlying layers. Official Gazette of the U.S. Patent and Trademark Office

N87-14595# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
ON 10-60 GHz G/T MEASUREMENTS USING THE SUN AS A SOURCE: A PRELIMINARY STUDY Report, 1985-1986
W. C. Daywitt Apr. 1986 22 p Sponsored by Air Force Satellite Control Facility
(PB86-230034; NBSIR-86-3046) Avail: NTIS HC A02/MF A01 CSCL 09E

Preliminary studies show that it may be possible: (1) to determine the solar flux density incident on the Earth's atmosphere using a simple algorithm with an uncertainty less than 8 percent; (2) to overcome a deteriorating accuracy in atmospheric loss calculations by using a tipping curve measurement, and (3) to reduce star-shape correction factor uncertainty by using an equivalent solar diameter. GRA

N87-14596*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW PHASE NOISE OSCILLATOR Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 14 May 1986 19 p
(NASA-Case-GSC-13018-1; NAS 1.71:GSC-13018-1;
US-Patent-Appl-SN-862959) Avail: NTIS HC A02/MF A01 CSCL 49O

A high frequency oscillator is provided by connecting two amplifier circuits in parallel where each amplifier circuit provides the other amplifier circuit with the conditions necessary for oscillation. The inherent noise present in both amplifier circuits causes the quiescent current, and in turn, the generated frequency, to change. The changes in quiescent current cause the transconductance and the load impedance of each amplifier circuit to vary, and this in turn results in opposing changes in the input susceptance of each amplifier circuit. Because the changes in input susceptance oppose each other, the changes in quiescent current also oppose each other. The net result is that frequency stability is enhanced. NASA

N87-14597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SWEPT FREQUENCY TECHNIQUE FOR DISPERSION MEASUREMENT OF MICROSTRIP LINES
Richard Q. Lee 1986 16 p Presented at the 1986 Antenna Applications Symposium, Monticello, Ill., 17-19 Sep. 1986; sponsored by Illinois Univ. and RADC
(NASA-TM-88836; E-3215; NAS 1.15:88836) Avail: NTIS HC A02/MF A01 CSCL 09C

Microstrip lines used in microwave integrated circuits are dispersive. Because a microstrip line is an open structure, the dispersion can not be derived with pure TEM, TE, or TM mode analysis. Dispersion analysis has commonly been done using a spectral domain approach, and dispersion measurement has been made with high Q microstrip ring resonators. Since the dispersion of a microstrip line is fully characterized by the frequency dependent phase velocity of the line, dispersion measurement of microstrip lines requires the measurement of the line wavelength as a function of frequency. In this paper, a swept frequency technique for dispersion measurement is described. The measurement was made using an automatic network analyzer with the microstrip line terminated in a short circuit. Experimental data for two microstrip lines on 10 and 30 mil Cuflon substrates were recorded over a frequency range of 2 to 20 GHz. Agreement with theoretical results computed by the spectral domain approach is good. Possible sources of error for the discrepancy are discussed. Author

N87-14598# Northeastern Univ., Boston, Mass. Electronics Research Lab.
NICAD BATTERY PACKAGES
Frederick J. Tracy and Harry M. Tweed, Jr. Feb. 1986 16 p
(Contract F19628-81-C-0029)
(AD-A170140; AFGL-TR-86-0052; SR-3) Avail: NTIS HC A02/MF A01 CSCL 10/3

Problems encountered with purchased battery packages and increasing requirements for larger capacity cells in sounding rocket

payloads led to the development of the battery packages in this report. Gell cells, lead acid batteries, silver cells and lithium batteries were considered along with nickel-cadmium (nicad) cells; however, nicads proved to be the most versatile. Several packaging concepts considering ease of assembly and servicing; minimization of weight and volume; and payload environmental requirements were evaluated. GRA

N87-14599# Department of the Navy, Washington, D. C.
NON-AQUEOUS PRIMARY CELL Patent Application
Stanley D. James, Patricia H. Smith, Kathleen M. ONeill, and Michael H. Wilson, inventors (to Navy) Filed 29 May 1986 14 p
(AD-D012428; US-Patent-Appl-SN-870213) Avail: NTIS HC A02/MF A01 CSCL 10/3

This patent application relates to electrochemical cells and especially to high-energy, liquid cathode, non-aqueous lithium electrochemical cells free from highly toxic materials. A non-aqueous lithium electrochemical cell is described which includes a halocarbon cathode depolarizer which is 1,2-dichloroethane, 1.1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1,2-dichloro-1,1-difluoroethane or mixtures thereof and a cathode catalyst which is copper, rhodium, palladium, cobalt phthalocyanine, nickel phthalocyanine, iron phthalocyanine, a cobalt tetraaza-(14)-annulene, a nickel tetraaza-(14)-annulene, a iron tetraaza-(14)-annulene, a cobalt porphyrin, a nickel porphyrin, a iron porphyrin, or a mixture thereof. GRA

N87-14600# Department of the Navy, Washington, D. C.
QUANTUM WELL ELECTRON BARRIER DIODE Patent Application
Steven W. Kirchoefer, inventor (to Navy) Filed 13 Mar. 1986 11 p
(AD-D012432; US-Patent-Appl-SN-839246) Avail: NTIS HC A02/MF A01 CSCL 20/12

This patent application relates to electron barrier diodes, and more particularly, to an asymmetric quantum well electron barrier diode. A quantum well electron barrier diode is described which comprises a substrate, a first buffer layer on the substrate, a superlattice structure on the first buffer layer, a second buffer layer on the superlattice structure, a contacting layer on the second buffer layer and first and second ohmic contacts attached to the contacting layer and substrate respectively. The superlattice structure comprises a sequence of a plurality of high energy gap barrier layers interleaved with a plurality of low energy gap wells. The sequence is repeated until the desired thickness is reached. Current flows perpendicular to the layers. GRA

N87-14601# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A ZERO EXTRACTION AND SEPARATION TECHNIQUE FOR SURFACE ACOUSTIC WAVE AND DIGITAL SIGNAL PROCESSING FIR (FINITE IMPULSE RESPONSE) FILTER IMPLEMENTATION M.S. Thesis
Keith V. Lindsay 1986 127 p
(AD-A170855; AFIT/CI/NR-86-93T) Avail: NTIS HC A07/MF A01 CSCL 09/1

Presented is a new method of separating the zeros of a Finite Impulse Response (FIR) filter producing an optimal digital filter or surface acoustic wave (SAW) design implementation. Overviews of zero extraction algorithms and of FIR design using the Remez Exchange algorithm are presented (McClellan et al. 1973). The computer aided design (CAD) procedure presented allows the designer to specify the general filter characteristic which the Remez algorithm translates to FIR time domain coefficients. These coefficients are readily translated to the frequency (z) domain, producing an Nth order polynomial in z. The characteristic polynomial is factoried to determine all roots or zeros using a three-stage factoring program presented by M.A. Jenkins (1975). The roots are optimally separated into two groups, each of which is recombined to form mutually exclusive functions. The two functions are then implemented as transducers of a SAW device or as a two-processor digital filter. The concept may be extended to more than two subgroups for multi-processor digital filter designs. Author (GRA)

N87-14602# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A SURVEY OF ALGORITHMS FOR INTEGRATING WAFER-SCALE SYSTOLIC ARRAYS Interim Research Report
Tom Leighton and Charles Leiserson May 1986 28 p
(Contract N00014-80-C-0622)
(AD-A171623; MIT/LCS/TM-302) Avail: NTIS HC A03/MF A01 CSCL 09/5

VLSI technologists are fast developing wafer-scale integration. Rather than partitioning a silicon wafer into chips as is usually done, the idea behind wafer-scale integration is to assemble an entire system (or network of chips) on a single wafer, thus avoiding the costs and performance loss associated with individual packaging of chips. A major problem with assembling a large system of microprocessors on a single wafer, however, is that some of the processors, or cells, on the wafer are likely to be defective. This paper surveys practical procedures for integrating around such faults. The procedures are designed to minimize the length of the longest wire in the system, thus minimizing the communication time between cells. Although the underlying network problems are NP-complete, all the procedures can be proved reliable by assuming a probabilistic model of cell failure. Author (GRA)

N87-14603# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SPECIAL TECHNIQUES FOR THE AUGER ANALYSIS OF MICROELECTRONIC DEVICES
M. S. Leung and G. W. Stupian 31 Jul. 1986 24 p
(Contract F04701-85-C-0086)
(AD-A171631; TR-0086(6945-09)-1; SD-TR-86-40) Avail: NTIS HC A02/MF A01 CSCL 14/2

Microelectronic devices are becoming more complex and device features are getting smaller as the level of integration continues to increase. Although scanning Auger microscopy has been applied extensively to the analysis of microelectronic devices with a great deal of success, the analysis of current and future devices is presenting new challenges. The major limitations are: (1) features of interest in microelectronic circuits are often comparable in size to the beam diameter of commercial Auger microprobes, and (2) the electron beam tends to drift about on the specimen surface because of mechanical instability and differential thermal expansion of the apparatus. In this technical report, we present information on two different techniques that were developed to overcome these limitations. In the specimen modulation technique, the modulating signal is applied to the electrical analyzer. This method of modulation permits the detection of only the Auger electrons that are emitted from the modulated region. GRA

N87-14604# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
INTRINSIC MECHANISMS OF MULTI-LAYER CERAMIC CAPACITOR FAILURE Annual Report, 15 Mar. 1985 - 14 Mar. 1986
L. C. Burton Apr. 1986 48 p
(Contract N00014-83-K-0168)
(AD-A171678) Avail: NTIS HC A03/MF A01 CSCL 09/1

The dominant charge carrier of leakage current in the BaTi03 based X7R ceramic that has been measured is the electron. Galvanic cell measurements yield oxygen ion transport numbers of essentially zero. The major effect of oxygen movement is not ionic current, but degradation. A generic degradation current-time curve is discussed. Two models for leakage current vs time are presented: one based on oxygen vacancy (and conduction electron) increase; the other on grain boundary barrier height reduction. Both predict exponential or near-exponential increase of leakage current with time, which has been reported. Reasons for the decrease in activation energy with degradation are discussed. This is attributed to decrease in polaron hopping or grain boundary potentials, or both. GRA

N87-14605# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
METHODOLOGY VERIFICATION OF HIERARCHICALLY DE-

SCRIBED VLSI CIRCUITS
Isaac L. Bain and Lance A. Glasser Jun. 1986 18 p
(Contract N00014-80-C-0622; Grant NSF ECS-81-18160)
(AD-A171742; VLSI-MEMO-86-327) Avail: NTIS HC A02/MF A01 CSCL 09/5

The standard approach to master the complexity of designing VLSI systems is to adopt a set of rules that, when respected, are conducive to correct implementations. Any such collection of rules can be called a design methodology. Most of the effort in computer-aided VLSI methodology verification has been traditionally concentrated on geometrical DRC. This paper describes a program that checks circuit conformity to other kinds of rules. This is done at the transistor level, and most of the rules are user-selected. Two related issues are also discussed: the description of digital MOS circuits using wiring operators; and the formal description of methodologies by the designer. Author (GRA)

N87-14606# Department of the Army, Washington, D. C.
ELECTRICAL RECEPTACLE Patent Application
Erwin FGeppert, inventor (to Army) Filed 28 Jul. 1986 15 p
(AD-D012528; US-Patent-Appl-SN-891808) Avail: NTIS HC A02/MF A01 CSCL 09/1

This invention relates to an electrical receptacle containing a multiple number of pin-type connectors, wherein the receptacle housing is a tubular metal member susceptible to manufacture by low cost screw machine procedures. Most surfaces of the metal member are centered on the tube axis, except that a circular flange on the member has a localized flat surface machined thereon for anti-rotation lock action. The receptacle is designed to be secured in place by a concealed nut for protection against theft or vandalism. GRA

N87-14607# Department of the Army, Washington, D. C.
DUAL BATTERY CONNECTOR ARRANGEMENT Patent Application
John A. Christopulos, inventor (to Army) Filed 17 Sep. 1986 12 p
(AD-D012544; US-Patent-Appl-SN-909365) Avail: NTIS HC A02/MF A01 CSCL 10/3

A lithium-sulfur-dioxide battery (e.g., the BA5847/U) is modified so that it can be used both in its customary manner or as a substitute for a standard Leclanche battery (e.g., the BA210/U). Since the aforementioned batteries typically have their connectors at different, distinct locations, the first-mentioned battery is provided with a second set of connectors (i.e., female sockets) which are located at the very same position as the connectors of the battery it may be substituted for. Thus, this battery has two sets of (2-hole) connectors and these are, in turn, interconnected in parallel. GRA

N87-14608# Lawrence Livermore National Lab., Calif.
PULSE SHAPING WITH TRANSMISSION LINES Patent Application
R. B. Wilcox, inventor (to DOE) Filed 15 Aug. 1985 15 p
(Contract W-7405-eng-48)
(DE86-013674; US-Patent-Appl-SN-765780) Avail: NTIS HC A02/MF A01

A method and apparatus for forming shaped voltage pulses uses passive reflection from a transmission line with nonuniform impedance. The impedance of the reflecting line varies with length in accordance with the desired pulse shape. A high voltage input pulse is transmitted to the reflecting line. A reflected pulse is produced having the desired shape and is transmitted by pulse removal means to a load. Light activated photoconductive switches made of silicon can be utilized. The pulse shaper can be used to drive a Pockels cell to produce shaped optical pulses. DOE

N87-14609# California Univ., Berkeley. Dept. of Chemical Engineering.
DESIGN OF THIN-GAP CHANNEL FLOW CELLS Ph.D. Thesis
V. Edwards Jul. 1986 412 p
(Contract DE-AC03-76SF-00098)
(DE86-016159; LBL-21848) Avail: NTIS HC A18/MF A01

Thin-gap channel electrochemical reactors are investigated. A thin-gap flow cell consists of parallel plates, each with an embedded electrode. Electrolyte flows between the plates, and electrochemical reactions occur on the electrode surfaces. The term thin-gap applies when the spacing between the plates is thin compared to the diffusion-boundary-layer thickness. A theoretical investigation of channel flow cells is given. A mathematical model is presented that includes the effects of interacting boundary layers, simultaneous electrochemical reactions, and ohmic potential drop. Two techniques are developed for calculating the steady-state current, concentration, and potential distribution in the flow cell. Experimental verification of the mathematical model is presented in the last two chapters. The experiments were carried out with a K3Fe(CN)6/K4Fe(CN)6/NaOH electrolyte in a channel flow cell with nickel electrodes. The current-voltage curves showed excellent agreement with the model over a wide range of boundary-layer thicknesses. DOE

N87-14610# Christian Rovsing Ltd., Copenhagen (Denmark).
DYNAMIC CURRENT DETECTOR (DCD) Final Report
Flemming Helsted Pedersen and Peter Breum Joergensen Paris, France ESA 8 Apr. 1986 104 p
(Contract ESTEC-4958/81-NL-35)
(SD/REPO/0001; ESA-CR(P)-2274; ETN-86-98137) Avail: NTIS HC A06/MF A01

The development of a so-called Dynamic Current Detector (DCD) to be used instead of sense resistors for conductance control in switchmode converters, or in general as a transducer, e.g., in the monitoring system in a power subsystem is described. The DCD is a current detector providing galvanic isolation between the wire in which it is detecting the current and the DCD output where a mirror of the detected current is presented in form of a voltage or a current. The DCD contains a Hall-device sensing the magnetic field induced by the current to be detected. Thus, galvanic isolation, linearity, and fast dynamic response is obtained for the detector. Comparison shows that for medium and large converters the DCD provides uninterrupted power return, and, is smaller, lighter, and less power dissipating than a sense resistor. ESA

N87-14611# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ELECTROTHERMAL GAS GENERATOR: DEVELOPMENT AND QUALIFICATION OF THE CONTROL ELECTRONICS Final Report, Jun. 1982
Guenther Matthaeus and Hans-Dieter Schmitz Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 87 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-006; ISSN-0170-1339; ETN-86-98760) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.50

The development and qualification of an electronic control circuitry for an electrothermal or catalytic hydrazine gas generator system is described. The circuitry, named manual override, controls the gas pressure in a tank using a pressure transducer and the gas generator to keep the pressure constant within narrow tolerances. The present pressure can be varied by ground command, enabling a variable thrust of the gas fed cold gas thrusters. The automatic loop can be switched off and the tank pressure be controlled by ground command. Two manual overrides SN01 and SN02 were qualified. ESA

N87-14612# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SHORT-CIRCUIT CURRENT INTERRUPTION IN A LOW-VOLTAGE FUSE WITH ABLATING WALLS
S. Ramakrishnan and W. M. C. vandenHeuvel Aug. 1985 44 p
(EUT-85-E-151; ISBN-90-6144-151-X; ISSN-0167-9708; ETN-86-98707) Avail: NTIS HC A03/MF A01

A computer simulated short-circuit current interruption in low-voltage fuses with no sand filling is described. The current interruption process in such fuses is aided by the ablation of the wall material of the fuse which helps to cool the arc column inside the fuse. An algorithm to solve the time-dependent energy

balance equation for the arc column taking into account the ablation of the wall material and the consequent pressure rise inside the fuse was developed. The numerical algorithm is linked with the equations describing a test circuit to provide 1500 A of short-circuit current from a 250 V, 50 Hz source. Results suggest that the current interruption process is dictated by the temperature distribution in the arc column immediately after the explosion of the fuse wire. The most likely reason for the successful operation of the fuse is that most of the joule heating in the arc column immediately after the explosion of the fuse wire occurs in the outer regions of the arc column close to the wall of the tube. ESA

N87-14613# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SHARPENING OF HORIZONTAL LUMINANCE TRANSITIONS IN TELEVISION PICTURES BY THE SIMULTANEOUS REDUCTION OF BUNDLE CURRENT AND HORIZONTAL SCAN SPEED Thesis [OPSCHERPING VAN HORIZONTALE LUMINANTIE-OVERGANGEN IN TELEVISIEBEELDEN DOOR SIMULTANE VERLAGING VAN DE BUNDELSTROOM EN DE HORIZONTALE SCANSNELHEID]
C. H. T. vanderHorst 1984 159 p In DUTCH
(E-EEA/324/84; ETN-86-98717) Avail: NTIS HC A08/MF A01

Velocity modulation, i.e., simultaneous coupled modulation of bundle current amplitude and scan speed in television systems was investigated in order to sharpen the luminance transitions in the picture. The characteristics of the projection tube are given. The horizontal aperture correction and its simulation are explained. In velocity modulation, the part of the luminance transition with the highest intensity is decelerated and written with a lower bundle current. A theoretical maximum sharpening of up to 58% can be realized. The simultaneous modulation of bundle current and scan speed during 100 nsec (symmetrically with respect to the transient) allows to approach the theoretically minimum transient width, with the restriction of an under and overshoot up to 10%. ESA

N87-14614# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
A NOISE REDUCTION SYSTEM FOR VIDEO SIGNALS WITH A LOW SIGNAL TO NOISE RATIO Thesis [EEN RUISREDUKTIES-YSTEEM VOOR VIDEOSIGNALEN MET EEN LAGE SIGN-AALRUISVERHOUDING]
J. Herrmann Jan. 1985 148 p In DUTCH; ENGLISH summary
(ETN-86-98720) Avail: NTIS HC A07/MF A01

A real time noise reduction system for static images in a scanning electron microscope was designed and realized. A 20-bit wide serial picture store and a first order recursive filter were used. The filter was adjusted according to the number of the frame in order to obtain as fast as possible a signal to noise ratio improvement; the noise reduction is between 0 and 42 dB. The noise reduction process can be restarted at any time. The filtered picture can be saved in the picture store and is shown on a second monitor; this picture is not affected by the noise reduction process. The filter process can be stopped to freeze the picture, which can then be examined without further scanning of the specimen. Low contrast images can be superposed to obtain a picture with a higher contrast. Two pictures can be subtracted to show the differences between them. ESA

N87-14615# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-K.
PULSE AMPLIFIER WITH HIGH COMMON-MODE REJECTION Thesis - Technische Hogeschool, Amsterdam, Netherlands [PULSVERSTERKER MET HOGE COMMON MODE REJEC-TION]
P. Ijlst 1986 68 p In DUTCH
(DIGEL-70; ETN-86-98724) Avail: NTIS HC A04/MF A01

A pulse amplifier which suppresses the high common-mode input signal by means of a special transformer was developed for pulsed electron beams in an electron accelerator. The Compton detector, common-mode signal, user requirements, design requirements, and scheme are presented. The theoretical treatment of second order systems, noise in operational amplifiers, and pulse transformers is explained. The optimization of the noise suppression, restoration of the dc level, transformer design, and choice of operational amplifier are outlined. The global circuit is presented. Measurements show that the required common-mode rejection ratio and bandwidth are not realized. The other specification (e.g., drift) are fulfilled. ESA

N87-14616# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
INVESTIGATIONS ON A BROADBAND 180 DEG HYBRID
Manfred Weisser and Karl Hans Waegel Feb. 1986 41 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-22; ISSN-0171-1342; ETN-86-98754) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 15

An asymmetrically supplied rectangular waveguide bifurcation with cascaded multiports was developed. An intermediate circuit consisting of diaphragms and conductors is provided for broadband matching transformations. The computation of the scattering matrices of the multiports is based on a field matching method. It is shown that an equal power division is difficult to realize for a 180 deg phase shift between the output signals. The always present excitation of disturbing mode reduces the bandwidth by tens of MHz. The practical realization is a power divider at 9.6 GHz with a 90 deg phase difference between the output signals and a bandwidth of 900 MHz. ESA

N87-14617# Institut National Polytechnique, Grenoble (France).
DESIGN OF PROGRAMMABLE LOGIC ARRAYS (PLA) CMOS Ph.D. Thesis [CONCEPTION DE LA PLA CMOS]
Abbas Dandache 1986 183 p In FRENCH; ENGLISH summary
(ETN-87-98590) Avail: NTIS HC A09/MF A01

The specification of an electrical and temporal evaluation tool based on the search of critical input-output paths for programmable logic arrays (PLA) is outlined. The distribution of the fault types after manufacturing; improving the manufacturing procedure by designing reconfigurable PLAs; and the partitioning of the arrays to reduce area and delay time, and to ease reconfiguration and connection to neighboring blocks are described. ESA

N87-14618# Institut National Polytechnique, Grenoble (France).
CONTRIBUTION TO THE STUDY OF A MONOLITHIC 32 BIT PROCESSOR IN CMOS TECHNOLOGY Ph.D. Thesis [CON-TRIBUTIONS A L'ETUDE D'UN PROCESSEUR MONOLITHIQUE 32 BITS EN TECHNOLOGIE CMOS]
Abdelaziz Ouerdani 1986 150 p In FRENCH Sponsored by l'Association pour le Developpement de la Recherche and by BULL SYSTEMES
(ETN-87-98592) Avail: NTIS HC A07/MF A01

The static and dynamic properties of mask design used in manufacturing CMOS blocks for VLSI circuits are studied. The method implies a design by successive specification improvements. The choice of algorithm and of functional blocks are discussed. It is shown that the proposed regular structures are easily adapted to automatic design, and that VLSI circuits must be seen as a set of functional blocks rather than complex logic gate circuits. ESA

N87-14619*# Spectrolab, Inc., Sylmar, Calif.
DESIGN, ANALYSIS AND TEST VERIFICATION OF ADVANCED ENCAPSULATED SYSTEMS Final Report, Period Ending 31 Oct. 1985
A. Garcia, III Nov. 1985 239 p
(Contract NAS-7-100)
(NASA-CR-177076; NAS 1.26:177076; DE-86-015839;
DOE/JPL-95567/85-16; DRL-126) Avail: NTIS HC A11/MF A01 CSCL 09A

Methods have been developed to aid the photovoltaic manufacturer in the design of modules which will optimize the use of materials and method of manufacture for novel encapsulation schemes. Methods are described for using master curves to enable the design of modules which will withstand pressure loading from wind and/or precipitation as well as stress produced from

diurnal and seasonal thermal cycling. Analysis methods using finite element modeling are presented to examine maximum electric field concentrations dependent on the geometry of cells and interconnects. Techniques for determining the operating temperature and optical efficiency of panels are presented. Several novel methods of manufacturing modules are described. Experimental results in the use of conductive polymers in photovoltaic cells as AR coatings, conductivity enhancers and passivation coatings are discussed. DOE

N87-14626 Stanford Univ., Calif.
A COMPUTER INTERFACE FOR DIGITAL CONTROL OF A dc POWER SOURCE, APPENDIX E
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 253-262 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N87-14620 Stanford Univ., Calif. Thermosciences Div.
EXPERIMENTS ON BUOYANCY-INDUCED CONVECTION HEAT TRANSFER FROM AN ARRAY OF CUBICAL ELEMENTS ON A VERTICAL CHANNEL WALL
Alfonso Ortega and R. J. Moffat Jun. 1986 325 p Sponsored by Burroughs Corp., IBM, and the Thermosciences Affiliates Fund (Contract NSF C-06337)
(SU-HMT-38) Copyright. Avail: Issuing Activity

Cooling of electronic components was studied. The relative importance of local buoyancy on the heat transfer to the individual elements was determined. A method was developed by which the temperatures of individual elements in such an array can be predicted given the heat dissipation from each element. Experiments were conducted on buoyancy-induced forced-convection heat transfer from an in-line array of cubical elements on a vertical surface. An analysis is presented for predicting the induced flow rate even with nonuniform heating in the streamwise direction. For the array used, the predicted flow is within 10% of the measured flow. For individual titles, see N87-14621 through N87-14629.

N87-14621 Stanford Univ., Calif.
EXPERIMENTS ON BUOYANCY-INDUCED CONVECTION HEAT TRANSFER FROM AN ARRAY OF CUBICAL ELEMENTS ON A VERTICAL CHANNEL WALL. CHAPTER 1: INTRODUCTION AND BACKGROUND
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 1-182 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

The cooling of an array of cubical elements mounted on one wall of a vertical parallel planes channel by buoyancy-induced or natural convection is addressed. Natural convection cooling of electronic components was modeled on vertically oriented circuit boards, where adjacent boards form channels, with one surface being relatively smooth, and the other populated by an array of large, heat dissipating elements. The need for accurate prototype testing cannot be eliminated, but the dependence on testng can be greatly diminished by: improved understanding of the fundamental aspects of the heat transfer and development of better predictive models based on sound physics and thoughtful experimental investigation. The heat transfer results for the sparse cube array provides an accurate predictive basis for electronics-cooling applications. B.G.

N87-14622 Stanford Univ., Calif.
ANALYSIS OF CONDUCTION FROM A HEATED CUBICAL ELEMENT TO A PLANE CONDUCTING WALL, APPENDIX A
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 183-194 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

Conduction from the heated element base to its host plane is of the same order of magnitude as natural convection and must be accurately accounted. Conduction heat flux gauges were built into several elements on the board to provide a direct measure of the base conduction. Those elements with built-in gauges were used to confirm predictions of the conduction loss. The development of the conduction model used in the data reduction program is presented in detail. B.G.

N87-14623 Stanford Univ., Calif.
MEASUREMENT OF THE TEMPERATURE-DEPENDENT THERMAL CONDUCTIVITY OF AN EPOXY ADHESIVE FOR USE IN AN ELEMENT BASE CONDUCTION GAUGE, APPENDIX B
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 195-207 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

The most important factors in setting the accuracy of the conduction heat flux gage were close tolerances as in the factor, and accurate calibration of the thermal conductivity of the epoxy used as the element across which the steady-state temperature difference is measured. It was not possible to calibrate the epoxy in its final form on the instrumented cubical element, therefore, a separate experiment was designed to measure the thermal conductivity as a function of temperature. The conductivity was measured in a configuration which was as close to the application as possible, covering a temperature range from 20 to 120 C. A slug calorimeter was used. The technique and experimental results are described. B.G.

N87-14624 Stanford Univ., Calif.
RADIATION FROM AN ELEMENT IN AN ARRAY TO ITS SURROUNDINGS, APPENDIX C
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 209-225 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

Equations were developed to calculate the net radiative heat transfer from an element in an array to its surroundings, given the temperatures of the elements, their adiabatic temperatures, and the temperatures of the opposing walls or enclosure. Two models were developed which bound the radiative transfer and, in the data-reduction program, used the average of the two. This treatment gives acceptable accuracy, in light of the magnitude of the radiation compared to the total heat input to the element. B.G.

N87-14625 Stanford Univ., Calif.
HOT-WIRE CALIBRATION AT VERY LOW VELOCITIES WITH TEMPERATURE COMPENSATION, APPENDIX D
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 227-252 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

In the velocity range to be measured, buoyancy effects must be taken into account in hot-wire calibration. A temperature compensation technique was undertaken to develop a suitable calibration capability. The DISA P14 5-micron hot wire probe was calibrated for measurement of a single mean-velocity component. The technique was tested at four different velocities covering the range of velocities between 1.5 and 30 cm/s and the correction factor did not vary by more than 10% in the entire range. B.G.

N87-14626 Stanford Univ., Calif.
A COMPUTER INTERFACE FOR DIGITAL CONTROL OF A dc POWER SOURCE, APPENDIX E **c33**
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 253-262 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

The design and operation of a digital to analog (D/A) interface used to remotely set the output from a Hewlett-Packard 855C Series dc power supply from a digital MINC PDP-11/03 base controller are briefly described. B.G.

N87-14627 Stanford Univ., Calif.
DIFFERENTIAL DERIVATION OF THE FULLY DEVELOPED LIMIT ON THE INDUCED CHANNEL REYNOLDS NUMBER, APPENDIX F
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 263-267 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

A channel is formed by two unobstructed walls, each of which may be heated. A relationship for the induced Reynolds number was then obtained. The equations are explained. B.G.

N87-14628 Stanford Univ., Calif.
DERIVATION OF A GENERAL INTEGRAL FORMULATION FOR THE BUOYANCY-INDUCED REYNOLDS NUMBER, APPENDIX G
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 269-275 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

The equations are presented for fully developed free convection for uniform heat release on one wall of the channel. The results are expressed in terms of a channel Grashof number, defined in terms of the average heat release per unit area and the channel spacing. A schematic of the problem geometry is presented. B.G.

N87-14629 Stanford Univ., Calif.
DERIVATION OF STEINBERG'S METHOD FOR PREDICTING INDUCED FLOW IN CABINETS
In its Experiments on Buoyancy-Induced Convection Heat Transfer from an Array of Cubical Elements on a Vertical Channel Wall Jun. 1986 p 277-302 (For primary document see N87-14620 06-34)
Copyright. Avail: Issuing Activity

Steinberg (1980) presented a result by which the maximum air temperature in a natural-convection-cooled cabinet can be computed given the total power dissipation and the system pressure losses. This is then used to deduce the equilibrium flow rate. The method is an example of current practice in natural-convection-cooled electronic systems and is explained. B.G.

N87-14630# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO VORTEX DYNAMICS, VOLUME 1
1986 310 p Lecture Series held in Rhode-Saint-Genese, Belgium, 26-30 May 1986
(VKI-LS-1986-08-Vol-1; ETN-87-98321) Avail: NTIS HC A14/MF A01

The fundamentals of vortex motion; vortex flows; a three dimensional viscous vortex; turbulent vortices; geophysical vortices and vortex rings; and modeling three dimensional vortex flows in aerodynamics were discussed. For individual titles, see N87-14631 through N87-14636.

N87-14631# Naval Academy, Annapolis, Md. Dept. of Mechanical Engineering.
FUNDAMENTALS OF VORTEX MOTION
Robert Granger *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 36 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

The characteristics of vortices and vorticity are recalled. Vortices in two and three dimensional flow are described. External and internal flow vortices are illustrated. ESA

N87-14632# Naval Academy, Annapolis, Md. Dept. of Mechanical Engineering.
REVIEW OF VORTEX FLOWS
Robert Granger *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, volume 1 1986 59 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

The characteristics of two dimensional potential flow, standing vortices, vortex rings, spherical vortices, and two and three dimensional viscous vortices are summarized. Vortices in an incompressible medium, in viscous media, time dependent flows, in two phase flow, and compressible flow are considered. ESA

N87-14633# Naval Academy, Annapolis, Md. Dept. of Mechanical Engineering.
A THREE DIMENSIONAL VISCOUS VORTEX
Robert Granger *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 80 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

A fluid rotating steadily in a circular cylinder with a nearly tangential influx of fluid through uniformly distributed jets located on an outer stationary cylindrical surface is analyzed. The fluid is withdrawn through a small orifice located at the center of the bottom end of the cylinder. A pump recirculates the fluid to maintain a constant depth. The equations of motion, including a similarity transformation and power series solution, are outlined. Experiments to study the steady axisymmetric vortex, and to study the response of the viscous core of the vortex to a perturbation are described. ESA

N87-14634# Naval Academy, Annapolis, Md. Dept. of Mechanical Engineering.
TURBULENT VORTICES
Robert Granger *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 47 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

Turbulence, turbulence velocity scales for swirling flows, the behavior of a three dimensional vortex, Reynolds-stress measurements in a turbulent trailing vortex, vortex motion arising from turbulent motion, vortex motions in jets and wakes, the turbulent confined vortex, and the stability of turbulent vortices are reviewed. Turbulence models, including the stress equation and k-epsilon models, are described. Vortex decay and closure are considered. ESA

N87-14635# University of Southern California, Los Angeles.
GEOPHYSICAL VORTICES AND VORTEX RINGS
Tony Maxworthy *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 10 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

The dynamics of vortex rings; laboratory modeling of geophysical vortices; and waves on concentrated vortices are discussed. ESA

N87-14636# Royal Aircraft Establishment, Farnborough (England).
MODELING THREE DIMENSIONAL VORTEX FLOW IN AERODYNAMICS **c02**
J. H. B. Smith *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 1 1986 67 p (For primary document see N87-14630 06-34)
Avail: NTIS HC A14/MF A01

Streamlines, vorticity, flow separation, and attachment and reattachment are discussed. Inviscid modeling of separated flows

is introduced. The initial behavior of a vortex sheet, and vortex decay are considered. Inviscid models for sharp edged wings, and separation from smooth surfaces are described. ESA

N87-14637# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO VORTEX DYNAMICS, VOLUME 2
1986 324 p Lecture Series held in Rhode-Saint-Genese, Belgium, 26-30 May 1986
(VKI-LS-1986-Vol-2; ETN-87-98322) Avail: NTIS HC A14/MF A01

Vortex breakdown; numerical simulation of vortical flow; compressibility effects on delta wing flow fields, and on flows around simple components; and measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry were discussed. For individual titles, see N87-14638 through N87-14643.

N87-14638# Brown, Boveri und Cie, A.G., Baden (Switzerland).
VORTEX BREAKDOWN IN TECHNOLOGY AND NATURE
Marcel P. Escudier *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 61 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

Nondimensional parameters of vortex breakdown, basic aspects of vortex flows, and the phenomenology of vortex breakdown are discussed. Swirl stabilized combustion, vortex amplifiers, turbomachine outlets, draft-tube surge, and atmospheric vortices are described. ESA

N87-14639# Brown, Boveri und Cie, A.G., Baden (Switzerland).
VORTEX BREAKDOWN THEORIES
Marcel P. Escudier *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 37 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

Instability, stagnation, and wave phenomena in vortex breakdown are reviewed. Axisymmetric disturbances; spiral disturbances; nonlinear interactions; the separation analogy; failure of slender core/quasi-cylindrical approximation; numerical failure; solitary waves; inertia waves; transition between conjugate-flow states; and the shock/hydraulic-jump analogy are discussed. ESA

N87-14640# National Aerospace Lab., Amsterdam (Netherlands).
NUMERICAL SIMULATION OF VORTICAL FLOW **c02**
H. W. M. Hoeijmakers *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 149 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

Discrete-vortex, vortex-lattice, and vortex blob methods, panel methods, and Euler (and Navier-Stokes) finite difference methods for computing weak interaction vortex flows (vortex wakes) and strong interaction vortex flows (leading-edge vortices) at wings are introduced. Comparison of pressure distributions computed by panel and Euler methods with measured values shows that secondary separation effects are often quite important. It is demonstrated that using a panel method secondary separation effects can be simulated. In Euler methods the secondary separation has to be modelled explicitly by specifying the separation line(s) and enforcing Kutta type conditions. ESA

N87-14641# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBILITY EFFECTS ON DELTA WING FLOW FIELDS **c02**
G. Vorropoulos and John F. Wendt *In its* Introduction to Vortex Dynamics, Volume 2 1986 36 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

The axial and tangential velocity components in the leading edge vortex of an aspect ratio 2, planar delta wing of 10 deg incidence were measured by laser Doppler velocimetry in the Mach number range from 0.18 to 0.80. For sufficiently high Mach numbers, the axial velocity distribution through the vortex exhibits a minimum near the vortex axis, instead of a maximum as under incompressible conditions. The axial velocity distribution becomes asymmetric about the vortex axis with increasing Mach number. Asymmetry is observed in the spanwise distribution of the tangential velocity for M = 0.80. The measurements do not support the theoretical model of the compressible conical vortex of Brown which assumed axisymmetric flow. It is postulated that the appearance of a local supersonic pocket and attendant shock wave is responsible for the development of the strong asymmetries; evidence from computations employing the Euler equations lends support. ESA

N87-14642# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBILITY EFFECTS ON FLOWS AROUND SIMPLE COMPONENTS **c02**
John F. Wendt *In its* Introduction to Vortex Dynamics, Volume 2 1986 21 p (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

The effects of compressibility on the flow fields and overall aerodynamic characteristics of low aspect ratio, sharp-edged planforms (rectangular, trapezoidal, and delta) and long ogive-cylinders at high incidence are considered. The leeside vortex-dominated flow structure, including vortex bursting is emphasized. Subsonic and supersonic regimes are included ; unsteady effects are not considered. ESA

N87-14643# Naval Academy, Annapolis, Md.
MEASUREMENTS OF THE IMPINGEMENT OF A VORTEX FLOW ON A CONTROL SURFACE BY 3D LASER VELOCIMETRY **c02**
Joseph Gillerlain and W. J. Yanta *In* Von Karman Inst. for Fluid Dynamics Introduction to Vortex Dynamics, Volume 2 1986 17 p Sponsored by the Naval Air Systems Command (For primary document see N87-14637 06-34)
Avail: NTIS HC A14/MF A01

Vortex-fin interaction was studied in a subsonic wind tunnel using a rectangular fin model adjustable for angle-of-attack. The impinging vortex was generated upstream of the fin at the juncture of two adjacent airfoils set at equal but opposite angles-of-attack. Force, moment, and pressure distribution data were obtained for one freestream velocity and one vortex strength. The three dimensional flow field was surveyed using a laser Doppler velocimeter. Experimental results are presented. ESA

N87-14644*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A NUMERICAL STUDY OF INCOMPRESSIBLE JUNCTURE FLOWS
Dochan Kwak, Stuart E. Rogers (Sterling Software, Palo Alto, Calif.), Upender K. Kaul, and James L. C. Chang (Rockwell International Corp., Canoga Park, Calif.) Aug. 1986 11 p
(NASA-TM-88319; A-86305; NAS 1.15:88319) Avail: NTIS HC A02/MF A01 CSCL 46B

The laminar, steady juncture flow around single or multiple posts mounted between two flat plates is simulated using the three dimensional incompressible Navier-Stokes code, INS3D. The three dimensional separation of the boundary layer and subsequent formation and development of the horseshoe vortex is computed. The computed flow compares favorably with the experimental observation. The recent numerical study to understand and quantify the juncture flow relevant to the Space Shuttle main engine power head is summarized. Author

N87-14645*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
IMPLICIT TIME-MARCHING SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR THRUST REVERSING AND THRUST VECTORING NOZZLE FLOWS
Scott T. Imlay Washington NASA Nov. 1986 192 p
(Contract NAS1-17170)
(NASA-CR-4026; NAS 1.26:4026) Avail: NTIS HC A09/MF A01

CSCL 46B

An implicit finite volume method is investigated for the solution of the compressible Navier-Stokes equations for flows within thrust reversing and thrust vectoring nozzles. Thrust reversing nozzles typically have sharp corners, and the rapid expansion and large turning angles near these corners are shown to cause unacceptable time step restrictions when conventional approximate factorization methods are used. In this investigation these limitations are overcome by using second-order upwind differencing and line Gauss-Siedel relaxation. This method is implemented with a zonal mesh so that flows through complex nozzle geometries may be efficiently calculated. Results are presented for five nozzle configurations including two with time varying geometries. Three cases are compared with available experimental data and the results are generally acceptable. Author

N87-14646# Naval Ship Research and Development Center, Bethesda, Md.

UNDERWATER EXPLOSION MODELING OF AN ENERGY ABSORPTION SYSTEM Final Report

David D. Moran and Martin J. Dipper May 1986 26 p

(AD-A168880; DTNSRDC-86/012) Avail: NTIS HC A03/MF A01 CSCL 19/4

The laboratory model was demonstrated with an explosion energy absorption system incorporating a flexible rubber diaphragm, filled with water, which inverts when subject to underwater explosion pressure. Explosion energy is dissipated in the work done in inverting the diaphragm and vertically accelerating the water. A small-scale model of an energy absorption tank was constructed and tested to allow examination of operational parameters fundamental to the energy absorption concept. A technique was developed to produce a range of explosion pressures to excite the energy absorption tank. The technique utilized high speed photography allowing visualization of the operational performance of a tank which has been subjected to an underwater explosion event. Flexible diaphragm inversion and water acceleration demonstrate distinct dynamic trends and are unsteady processes. The experimental results indicate that the dynamic trends characterizing these processes were repeatable in form over the range of explosion pressures. Forces obtained through this technique represent forces imparted to the tank through the resistance screens and top grate as impediments to water flow. Water flow impedance provided by a resistance screen was found to be a function of resistance element position within the tank. The magnitude and duration of the impedance forces could be changed through variation of the resistance element vertical configuration. GRA

N87-14647# Ballistic Research Labs., Aberdeen Proving Ground, Md.

PNS (PARABOLIZED NAVIER-STOKES) FOR SPINNING SHELL AT MODERATE ANGLES OF ATTACK AND FOR LONG L/D FINNED PROJECTILES Final Report

Paul Weinacht, Bernard J. Guidos, Walter B. Sturek, and Betty A. Hodes Jun. 1986 49 p

(AD-A169531; BRL-MR-3522) Avail: NTIS HC A03/MF A01 CSCL 20/4

The thin-layer Parabolized Navier Stokes (PNS) computational technique is applied to calculate the three-dimensional viscous flow about two types of projectiles: (1) a standard shell configuration at moderate angle of attack with a region of lee side crossflow separation and (2) long L/D finned projectiles. Results for the shell configuration are obtained using the algebraic turbulence model for Baldwin and Lomax with and without modifications that more properly account for regions of lee side crossflow separation. Comparisons are made with wind tunnel pressure and force measurements as well as boundary layer velocity data. For a nonspinning shell, significant improvement in prediction of surface pressure at 6.3 degrees angle of attack is found by applying the modified model. For a spinning shell, good agreement between the numerical predictions and the experimental Magnus force and velocity profile data is found only if the turbulence model modification strategy is relaxed. Results are then presented for the L/D finned projectile configurations. Computed pitch-plane aerodynamic coefficients for long L/D axisymmetric forebodies (20 to 35 calibers) are presented and compared with wind tunnel data. The results, which are in reasonable agreement with the experimental data, demonstrate the importance of viscous effects on the pitch plane aerodynamics for long L/D bodies. Computations for a complete finned body configuration are presented and comparison made with inviscid code predictions. GRA

N87-14648# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

EVALUATION OF DATA ON SIMPLE TURBULENT REACTING FLOWS Interim Scientific Report, 1 Oct. 1984 - 30 Sep. 1985

Warren C. Strahle and Spyridon G. Lekoudis Sep. 1985 478 p (Grant AF-AFOSR-0356-83)

(AD-A170071; AFOSR-85-0880TR) Avail: NTIS HC A21/MF A01 CSCL 20/4

A large number of data sets on simple turbulent reacting and non-reacting flows are reviewed with a view toward judgement as to their suitability for computational test. Both premixed and nonpremixed flows are considered, but the review is limited to simple geometries and flows which could be analytically treated as an initial value (parabolic) problem. Nine flows are identified as being sufficiently well documented and understood to serve as bases for testing of computational methods and models. The data for these flows are tabulated or graphically displayed in this report. GRA

N87-14649# Cornell Univ., Ithaca, N.Y. School of Mechanical and Aerospace Engineering.

[STUDY OF PHENOMENA OF UNSTEADY BOUNDARY-LAYER SEPARATION]

S. F. Shen 20 Jun. 1986 9 p

(Contract N00014-77-C-0033)

(AD-A170428) Avail: NTIS HC A02/MF A01 CSCL 20/4

The central theme of research under this grant had been the study of phenomena of unsteady boundary layer separation, emphasizing but not restricted to the Lagrangian description. GRA

N87-14650# Pennsylvania State Univ., University Park. Applied Research Lab.

BUBBLE DYNAMICS AND CAVITATION INCEPTION THEORY

Blaine R. Parkin and Brian B. Baker 30 Jul. 1986 27 p

(Contract N00024-85-C-6041)

(AD-A170603; ARL/PSU/TM-86-121) Avail: NTIS HC A03/MF A01 CSCL 20/4

In order to provide some theoretical background and to motivate the more refined theory introduced below, some encouraging known theoretical results on bubble ring captivation inception are reviewed. This review is followed by the development of the theory of bubble ring cavitation cutoff. Its outcome, when compared with experiment, shows the needs for a more refined inception theory. The above comparison and the basic ideas behind the cutoff theory's formulation suggest a possible approach for a refinement based on a multiple scales expansion. This seems reasonable because the forcing function pulse in laboratory time, t, varies slowly compared to the characteristic bubble time, tau, which characterizes the response time of a typical microscopic cavitation nucleus. The ratio of these two times gives us a small parameter epsilon, appearing in the forcing function, with the result that this problem involves only a soft excitation. GRA

N87-14651# Washington Univ., Seattle.

RADIATIVE ENERGY TRANSFER AND THERMAL MANAGEMENT IN ADVANCED SPACE POWER AND PROPULSION SYSTEMS Annual Report, 1 Oct. 1983 - 30 Sep. 1984

A. T. Mattick and A. Hertsberg 4 Mar. 1986 24 p (Grant AF-AFOSR-0367-83)

(AD-A170838; AFOSR-86-0565TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

This work involved a theoretical study of radiation transfer in droplet clouds, for predicting the performance of the liquid droplet radiator. The effects on droplet sheet emissivity of non isotropic

scattering by droplets and of the development of a temperature profile on the droplet sheet are shown to be small. GRA

N87-14652# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MODEL SIMULATION OF A LOCALIZED HIGH INTENSITY HEAT SOURCE INTERACTING WITH COOLED METAL PLATES M.S. Thesis
Frank M. Cranfill 1986 99 p
(AD-A170856; AFIT/CI/NR-86-87T) Avail: NTIS HC A05/MF A01 CSCL 18/9

The basic, generic problem of a localized high intensity heat source directed against one surface of a plate of finite thickness was investigated using the finite element program ANSYS. After reviewing similar work in nuclear fuel and laser machining, ANSYS was verified against a known solution. ANSYS was used to create a model that yields minimum heat transfer coefficients needed to prevent the initiation of melting in thin aluminum, titanium, and stainless steel (AISI 304) plates. These heat transfer coefficients were converted into minimum local Nusselt numbers and graphed against local Nusselt number correlations for constant temperature flat plates in forced and free convection regimes. A detailed listing of both laminar and turbulent correlations is presented along with references. The suitability of liquid sodium, air, and water (under high pressure) as coolants for a source intensity of 2.0 x 10 to the 7th power w/sq m was examined. For free convection, only liquid sodium cooling a titanium plate is feasible, For forced convection, liquid sodium is feasible in laminar flow fo r all three plates with velocities ranging from 0.28 m/s to 1.09 m/s. Water is feasible for aluminum and titanium in turbulent flow at velocities of approximately 4 m/s. GRA

N87-14653# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
AN INTRODUCTION TO HEAT TRACING
Karen Henry Jun. 1986 23 p
(AD-A170877; CRREL-TD-86-1) Avail: NTIS HC A02/MF A01 CSCL 20/13

Heat tracing is the generic term which refers to the application of heat to a pipeline or vessel to prevent freezing, to thaw frozen fluid, to maintain viscosity or temperature of a fluid, or for other reasons such as to keep components from separating or gas from condensing. The purpose of this digest is to summarize current heat tracing practices-their principles of operation, advantages and disadvantages. Heat tracing methods covered include heat transfer fluids (glycols and heat process fluids), steam, and electricity (resistance, skin effect, impedance and inductance). Author (GRA)

N87-14654 Department of the Air Force, Washington, D.C.
MAGNETIC BIAS AND DELAY LINEARITY IN A MAGNETOSTATIC WAVE DELAY LINE Patent
Korda K. Jin, inventor (to Air Force) Issued 12 Aug. 1986 11 p Supersedes US-Patent-Appl-SN-664193
(AD-D012526; US-Patent-4,605,911; US-Patent-Appl-SN-664193; US-Patent-Class-333-144) Avail: US Patent and Trademark Office CSCL 09/1

This patent discloses a cascade combination of magnetostatic delay line elements operating in different signal propagation modes for the purpose of achieving dispersion cancellation; magnetic bias control of the attained frequency-dependent delay and a magnetic bias field establishing apparatus for providing the tubular, laminar magnetic flux needed for backward volume wave operation of a magnetostatic delay element are also included. GRA

N87-14655# Pennsylvania State Univ., State College. Applied Research Lab.
WALL PRESSURE FLUCTUATIONS AND ACOUSTICS IN TURBULENT PIPE FLOW
M. A. Daniels and G. C. Lauchle Sep. 1986 120 p
(AD-A173359; ARL/PSU/TR-86-006) Avail: NTIS HC A06/MF A01 CSCL 20/4

Measurements of the turbulent boundary layer (TBL) wall pressure spectrum and the facility's propagating acoustic field were conducted in the Boundary Layer Research Facility. Subminiature, piezoresistive-type pressure transducers were used. Detailed calibration of the pressure transducers was performed using a standing wave tube. Measured sensitivities of the transducers were within 0.5 dB of factory specifications and measured phase differences between individual transducers were insignificant. The TBL wall pressure spectrum was obtained using a novel signal-processing technique that allowed a minimization of both acoustic and vibration-induced noise. This technique uses pairs of transducer difference signals from an exisymmetric array of three flush-mounted pressure sensors and permits cancellation of the propagating acoustic and vibrationally induced pressure fields. A measurement involving the coherence function between these transducer signals was shown to validate the measured TBL wall pressure spectra and all assumptions used in developing the measurement technique. Non-dimensionalized spectra of the TBL fluctuating wall pressure measured in this investigation are compared to those measured previously. These comparisons substantiated a maximum, normalized transducer diameter for the complete resolution of the high-frequency part of the TBL wall pressure spectrum. GRA

N87-14656# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
THREE-DIMENSIONAL EULER FLOW SIMULATION ON A CYBER 205 VECTOR COMPUTER
P. J. Koppenol Mar. 1985 65 p Sponsored by Control Data B.V., Rijswijk, Netherlands
(NLR-TR-85054-U; B8669019; ETN-86-98652) Avail: NTIS HC A04/MF A01

A computational method for solving the three dimensional Euler equations, based on an upwind flux-difference splitting scheme by Osher, exhibiting an implicit mechanism for numerical viscosity, with an explicit time-marching finite volume technique is studied. The computer program runs efficiently on a scalar computer and the Cyber 205 vector computer. Demands made by the necessity of vectorizability of the code, on algorithm, data structuring, and the code itself, are discussed. The large data sets involved appear to impose severe claims on central memory size, I/O devices, and line connections. The method is tested for a transonic and supersonic quasi two dimensional channel flow. The Euler model is found to give an accurate simulation of aerodynamic phenomena in the channel. ESA

N87-14657# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
MEASUREMENTS OF THE LOW-WAVE-NUMBER STRUCTURE OF A TURBULENT BOUNDARY LAYER
C. S. Subramanian, B. S. Kandola, and P. Bradshaw Dec. 1985 100 p
(Grant SERC-GR/C/56856)
(IC-Aero-85-01; ISSN-0308-7247; ETN-86-98390) Avail: NTIS HC A05/MF A01

Turbulence in a flat-plate boundary layer, was measured, emphasizing the large-scale contributions to the instantaneous strain rate and instantaneous vorticity which provides the source term in the Poisson equation for the pressure fluctuation. Measurements of triple-product correlations provide information about the diffusion of Reynolds stress. The results illustrate the behavior of turbulent length scales. ESA

N87-14658# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
COMPUTATIONAL FLUID DYNAMICS IN ENGINEERING AND EDUCATION
D. Brian Spalding Apr. 1986 14 p Lecture presented at Rensslelaer Polytechnic Institute Sadowsky Series, New York, N.Y., 8 Apr. 1986
(CFDU/86/6; ETN-86-98625) Avail: NTIS HC A02/MF A01

The basics of computational fluid dynamics (CFD) are recalled, and the place of CFD in engineering and education is described. Software and hardware requirements are discussed. ESA

N87-14659# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
CFD IN THE AUTOMOBILE INDUSTRY
D. Brian Spalding Apr. 1986 21 p Presented at a conference, Turin, Italy, 9 May 1986
(CFDU/86/7; ETN-86-98626) Avail: NTIS HC A02/MF A01

Computational fluid dynamics (CFD) applications in the automobile industry to external aerodynamics and to in-cylinder phenomena, and the large range of potential applications which remain to be developed are discussed. The problem of CFD management is considered. It is argued that the use of CFD in industry is hindered by the use of special-purpose codes, which their creators have too little time or motive to make easily transferable. It is proposed that introduction will be swifter, and management more effective, if all the CFD needs of a single organization are met by a single CFD-code system. ESA

N87-14660# Institut de Mecanique des Fluides de Toulouse (France). Equipe Transferts en Ecoulements Laminaires et Turbulents.
NUMERICAL SIMULATION OF TURBULENT STRUCTURES IN A MIXING ZONE Final Report [SIMULATION NUMERIQUE DES STRUCTURES TOURBILLONNAIRES D'UNE ZONE DE MELANGE]
A. Kourta Jun. 1985 70 p In FRENCH
(Contract DRET-84-1412/DS/SR)
(ETN-87-98582) Avail: NTIS HC A04/MF A01

A numerical analysis in two dimensional flow of the mixing zone obtained with a profile presenting an inflexion point is presented. The algorithms and the models used are discussed. Artificial excitation of the mixing zone is also examined. Visualization techniques are used to show the evolution of the mixing zone. The models are confirmed and the role played by the first subharmonic in the dynamics of the mixing zone is shown. ESA

N87-14661# Institut Franco-Allemand de Recherches, St. Louis (France).
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE TURBULENT BOUNDARY LAYER BEHIND A PISTON IN A TUBE [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNG DER TURBULENTEN GRENZSCHICHT HINTER EINEM KOLBEN IM ROHR]
F. Seiler 9 Dec. 1985 43 p In GERMAN Presented at the 11th Symposium on Innenballistische Leistungssteigerung von Rohrwaffen, Swisttal-Heimerzheim, West Germany, 11-13 Nov. 1985
(Contract BMVg-T/R-760/F-0007/F-1707)
(ISL-CO-246/85; ETN-87-98800) Avail: NTIS HC A03/MF A01

The compressible, turbulent boundary layer in a gun barrel was calculated and experimentally verified. The exterior flow behind the projectile for a given projectile position is constant; the instantaneous flow conditions at the projectile base are taken into account in the calculation; the turbulent velocity profile in the boundary layer obeys an exponential law; the whole boundary layer consists of an unsteady piston boundary layer and a stationary plate boundary layer. The connection between the two layers was made where they have equal thickness. The solutions provide expressions for the boundary layer thickness, the heat flux density, and the transversal velocity. The computation results were verified using an experimental gun working with air under realistic flow conditions. ESA

N87-14662# European Space Agency, Paris (France).
MAIN TYPES OF FREE SEPARATION IN MODEL ELLIPSOIDS
Henri Werle Sep. 1986 87 p Original language document was announced as N86-32691
(ESA-TT-990; ONERA-NT-1985-7; ETN-87-98830) Avail: NTIS HC A05/MF A01

Hydrodynamic visualization tests were performed to study free three dimensional separation at high angles of attack in turbulent flow. A hydraulic tunnel was used. The variation of separation with Reynolds number and incidence are shown, as well as the effect of the model shape parameters such as aspect ratio, relative thickness, and symmetry. ESA

N87-14663# European Space Agency, Paris (France).
INSTATIONARY FLOW EFFECTS IN THE ROTOR OF A TURBINE
Anton Binder Sep. 1986 154 p Original language document was announced as N86-32694
(ESA-TT-1001; DFVLR-FB-85-66; ETN-87-98832) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 51

Instationary turbine rotor flow effects caused by interactions between rotor and stator rows are analyzed. Measurements were carried out on a single-stage, high-pressure turbine, using conventional probes and the noninterfering laser-two-focus anemometer. The investigation of the instationary rotor flow begins with its source: the nonuniform stator exit flow. It is shown that the individual stator exit flow regions, such as the wakes and secondary vortices, are chopped up by the rotor. Because of this chopping, instationary flow phenomena appear in the rotor, leading to elevated turbulence levels and higher losses, and causing a transport of mass transverse to the flow direction. ESA

N87-14664# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Grenzschichten und Unterschallstroemungen.
EXPERIMENTAL INVESTIGATIONS ON THE STABILITY AND TRANSITION OF THREE-DIMENSIONAL BOUNDARY LAYERS Ph.D. Thesis - Goettingen Univ., West Germany
Petra Nitschke-Kowsky Jun. 1986 136 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-24; ISSN-0171-1342; ETN-87-98854) Avail: NTIS HC A07/MF A01

Three-dimensional, instable boundary layers were investigated as to their characteristic instabilities, leading to turbulence. Standing cross-flow instabilities and traveling waves preceding the transition were visualized with the hydrogen bubble technique in the boundary layer above the wall of a swept cylinder. With the sublimation method and hot film technique, a model consisting of a swept flat plate with a pressure-inducing displacement body in the 1 m wind tunnel was studied. Standing waves and traveling waves in a broad frequency band are observed. The boundary layer of this model is close to the assumptions of the theory. ESA

N87-14665# European Space Agency, Paris (France).
NUMERICAL STUDY OF THE LAMINAR SHOCK-BOUNDARY LAYER INTERACTION
Edgar Katzer Apr. 1986 154 p Original language document was announced as N86-15642
(ESA-TT-958; DFVLR-FB-85-34; ETN-87-98816) Avail: NTIS HC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 42

The interaction of an oblique shock wave with a laminar boundary layer on an adiabatic flat plane was analyzed numerically with solutions of the two dimensional Navier-Stokes equations using McCormack's explicit finite volume method. The agreement between numerical calculations and experimental results is good. Local and global properties of the interaction region are discussed regarding shock strength, separation bubble length using a similarity law, and separation environment. The assymmetrical structure inside the separation bubble produces an assymmetrical shape of the wall shear stress distribution. The calculation speed was increased by algorithm vectorization on a CRAY 1S supercomputer. Further investigations for determination of a similarity law in interaction with turbulent boundary layer, of the physical mechanisms of the laminar interaction, and for study of the wall temperature transfer are recommended. ESA

N87-14666# European Space Agency, Paris (France).
INVESTIGATION OF LARGE SCALE STRUCTURES IN A SUBSONIC FREE JET
Hans-Heinrich Claus Jun. 1986 97 p Original language document was announced as N86-15644

(ESA-TT-962; DFVRL-FB-85-38; ETN-87-98817) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 29.50

Large scale structures in a subsonic free jet were investigated using shadow photographs at Mach numbers from 0.03 to 0.1, with jet acoustic excitation. The shadow photographs show the free jet evolution from the nozzle exhaust to the turbulence entry. The point of instability is characterized by the shear flow thickness corresponding to a critical Reynolds number. The vortex convection velocity in an acoustically excited free jet studied with streak picture illumination depends on the nozzle distance and Strouhal number. The dependence shows good agreement with the course of the phase velocity of density gradient deviations in a natural free jet. The large scale structures in a natural free jet found by average determination of the time rate density gradient deviations does not show any periodic behavior at Mach numbers from 0.3 to 0.6. Investigation of their behavior was completed by visualization using illuminated streak photographs. ESA

N87-14667# European Space Agency, Paris (France).
A DIRECT METHOD FOR EVALUATING THE DISTURBANCE FIELDS OF MOVING SINGULARITIES AT SUBSONIC SPEEDS IN COMPRESSIBLE MEDIA
Hans-Heinrich Kohlmeier Sep. 1986 99 p
(ESA-TT-977; DFVLR-FB-85-52; ETN-87-98885) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 30

A panel method for the analysis of three dimensional steady compressible subsonic flows was developed. It is based on a first order panel method, into which Mach-number dependent aerodynamic influence coefficients are incorporated. The procedure using linearized theory takes into account the real magnitudes of potentials and velocities that are induced by disturbance sources at a point in space and which in compressible flow differ from that in incompressible flow. In this way it is possible to apply the exact boundary condition directly at the original body surface. Comparisons of solutions obtained by this method with measurements and with the results from methods solving full potential equation show good agreement for subcritical Mach numbers.ESA

N87-14668# European Space Agency, Paris (France).
CRITERIA FOR SEPARATION IN TWO-DIMENSIONAL STEADY AND UNSTEADY COMPRESSIBLE FLOW
Fuqing Zhang and Hans Foerscning Sep. 1986 57 p Original language document was announced as N86-28382
(ESA-TT-985; DFVLR-FB-85-60; ETN-87-98890) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 16

Separation criteria for two-dimensional flows were deduced. The most important technical flow separation phenomena are reviewed, and the governing physical influence parameters are outlined. The starting points were the theory of viscous flow and Prandtl's boundary layer concept. The most important existing flow separation criteria are discussed. From a study of the streamline behavior near a separation point, generalized criteria for separation in two-dimensional steady and unsteady compressible flow are derived. It is shown that the existing criteria are special cases of the generalized criteria. ESA

N87-14249# National Aerospace Lab., Tokyo (Japan).
NUMERICAL ANALYSIS OF NOZZLE AND FREE-JET FLOWS OF PARTICLE MIXTURES
Ryuji Ishii *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 7-12 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14256# National Aerospace Lab., Tokyo (Japan).
COMPRESSIBLE FLOW ANALYSIS IN TURBOMACHINERY
Masahiro Ikegawa, Yoshio Shikano, and Susumu Nakano *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 69-75 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14257# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENT OF THE HIGHLY LOADED AXIAL FLOW TURBINE AIRFOILS, MAKING USE OF THE IMPROVED INVERSE CHANNEL FLOW DESIGN METHOD
Keisuke Hashimoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 77-87 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14259# National Aerospace Lab., Tokyo (Japan).
A FINITE ELEMENT METHOD FOR HIGH REYNOLDS NUMBER FLOW
Ryutaro Himeno and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 97-101 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14263# National Aerospace Lab., Tokyo (Japan).
APPLICATION OF THE e SUP N METHOD TO CALCULATIONS OF LAMINAR FLOW CONTROL
Yoji Ishida and Nobutake Itoh *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 131-138 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14264# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONAL STUDY OF FLOW IN CURVED PIPES WITH CIRCULAR-SECTION
Susumu Shirayama, Tetsuya Kawamura, and Kunio Kuwahara *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 139-146 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14265# National Aerospace Lab., Tokyo (Japan).
EFFECTS OF BOUNDARY CONDITIONS IN NUMERICAL EXPERIMENTS FOR TURBULENT FLOWS
Toshio Kobayashi and Kozo Kitoh *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 147-151 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14269# National Aerospace Lab., Tokyo (Japan).
COMPUTATIONS OF TWO AND THREE-DIMENSIONAL FLOWS USING AN ADAPTIVE MESH
Kazuhiro Nakahashi *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 197-207 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14339# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
JET MIXING LOW [STRAHLMISCHUNG]
Bernhard Bauer and Welf Ebeling *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 201-242 In GERMAN Previously announced as N83-34831 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

N87-14401# Grenoble-1 Univ. (France). Centre de Recherches et d'Essais de Machines Hydrauliques.
PARTIAL CAVITATION ON PUMP BLADES
J. L. Schultz and J. L. Kueny *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 55-62 Sponsored by CNES (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14402# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
FLUID DYNAMIC PROBLEMS IN SPACE SYSTEMS
E. Slachmuylders, W. Berry, D. N. Soo, and C. Savage *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 65-82 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14407# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
MONODISPERSE DROPLET STREAMS AND THEIR APPLICATION IN SPACE
K. Anders *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 119-125 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14410# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
PRELIMINARY RESULTS FROM THE EMTE FUEL SLOSH FLIGHT EXPERIMENT
G. Netter and H.-G. Beig *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 145-157 (For primary document see N87-14394 06-18)
(Contract ESTEC-6419/85-NL-AN(SC))
Avail: NTIS HC A10/MF A01

N87-14411# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
HEAT PIPE EXPERIMENT ON SPAS 01
H. Kock, H. Kreeb, and C. Savage (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 159-173 Sponsored by BMFT and ESA (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

N87-14545# Koninklijke/Shell-Lab., Amsterdam (Netherlands).
DISCHARGES OF SATURATED LIQUEFIED GASES FROM PRESSURE VESSELS
H. E. A. vandenAkker *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 79 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

N87-14546# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Lab. de Physique et Metrologie des Aerosols.
FORMATION AND DYNAMICS OF AEROSOLS
D. Boulaud *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 27 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

N87-14547# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Lab. de Physique et Metrologie des Aerosols.
TRANSPORT OF TOXIC MATERIAL IN AEROSOL PHASE
D. Boulaud *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 26 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

N87-14548# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Centre d'Etudes Nucleaires.
NUMERICAL MODELING OF AEROSOLS
J. Gauvain and A. LHomme *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 27 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

N87-14551# Hoechst A.G., Frankfurt am Main (West Germany). Technishe Pruefung.
THERMOHYDRAULICS DURING VENTING OF TWO-PHASE SYSTEMS
L. Friedel *In* Von Karman Inst. for Fluid Dynamics Two Phase Flows in Major Technological Hazards, Volume 2 1986 68 p (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N87-14669* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VIBRATION-FREE RAMAN DOPPLER VELOCIMETER Patent
Reginald J. Exton Issued 25 Nov. 1986 9 p Filed 25 Apr. 1985 Supersedes N85-29216 (23 - 18, p 3104)
(NASA-Case-LAR-13268-1; US-Patent-4,624,561;
US-Patent-Appl-SN-727034; US-Patent-Class-356-28.5;
US-Patent-Class-356-301) Avail: US Patent and Trademark Office CSCL 14B

A method and apparatus unaffected by vibrational environments for obtaining measurements using Raman Doppler Velocimetry is described. Two laser beams, a pump beam, and a probe beam, are focused by a lens to a point in a flow. A lens collimates the two beams. A beam splitter dumps the beam and the other beam is reflected by a corner cube back to the lens. The other lens then focuses the beam back to the point. The reflected beam and the backward and forward scattering at the point are detected by a detector and processed by a boxcar averager. The lens and corner cube combination, called a retrometer, ensure that the measurements are unaffected by vibrations.

Official Gazette of the U.S. Patent and Trademark Office

N87-14670* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMITTED VIBRATION MEASUREMENT DEVICE AND METHOD Patent
Gary L. Gisler, inventor (to NASA) (Sperry Corp., Phoenix, Ariz.) Issued 28 Oct. 1986 9 p Filed 3 Oct. 1984 Supersedes N85-20299 (23 - 11, p 1635)
(NASA-Case-MFS-25981-1; US-Patent-4,619,142;
US-Patent-Appl-SN-657310; US-Patent-Class-73-462;
US-Patent-Class-73-473; US-Patent-Class-73-477) Avail: US Patent and Trademark Office CSCL 14B

This invention is directed to a method and apparatus for measuring emitted vibrational forces produced by a reaction wheel assembly due to imbalances, misalignment, bearing defects and the like. The apparatus includes a low mass carriage supported on a large mass base. The carriage is in the form of an octagonal frame having an opening which is adapted for receiving the reaction wheel assembly supported thereon by means of a mounting ring. The carriage is supported on the base by means of air bearings which support the carriage in a generally frictionless manner when supplied with compressed air from a source. A plurality of carriage brackets and a plurality of base blocks provided for physical coupling of the base and carriage. The sensing axes of the load cells are arranged generally parallel to the base and connected between the base and carriage such that all of the vibrational forces emitted by the reaction wheel assembly are effectively transmitted through the sensing axes of the load cells. In this manner, a highly reliable and accurate measurment of the vibrational forces of the reaction wheel assembly can be had. The output signals from the load cells are subjected to a dynamical analyzer which analyzes and identifies the rotor and spin bearing

components which are causing the vibrational forces.
Official Gazette of the U.S. Patent and Trademark Office

N87-14671* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF FABRICATING AN IMAGING X-RAY SPECTROMETER Patent
George E. Alcorn and Andre S. Burgess Issued 21 Oct. 1986 7 p Filed 18 Jun. 1985 Supersedes N86-20754 (24 - 11, p 1776)
(NASA-Case-GSC-12956-1; US-Patent-4,618,380;
US-Patent-Appl-SN-745977; US-Patent-Class-148-187;
US-Patent-Class-148-188; US-Patent-Class-148-189;
US-Patent-Class-148-190; US-Patent-Class-29-580;
US-Patent-Class-29-591) Avail: US Patent and Trademark Office CSCL 14B

A process for fabricating an X-ray spectrometer having imaging and energy resolution of X-ray sources is discussed. The spectrometer has an array of adjoinging rectangularly shaped detector cells formed in a silicon body. The walls of the cells are created by laser drilling holes completely through the silicon body and diffusing n(+) phosphorous doping material therethrough. A thermally migrated aluminum electrode is formed centrally through each of the cells. Official Gazette of the U.S. Patent and Trademark Office

N87-14672# Bascom-Turner Instruments, Norwood, Mass.
FABRICATION AND TESTING OF A PROTOTYPE HANDHELD ELECTROCHEMICAL CO MONITOR Final Report, Jun. 1984 - Jul. 1985
M. W. Rupich, G. L. Holleck, H. F. Wise, J. P. Hachey, and R. L. Dekermendjian Aug. 1985 71 p
(Contract GRI-5083-251-0944)
(PB86-233848; GRI-86/0174) Avail: NTIS HC A04/MF A01 CSCL 14B

A portable carbon monoxide monitoring instrument was developed for use by the gas utility service industry. A promising instrument was designed and tested under laboratory conditions. The instrument uses a stripping voltammetry technique to measure carbon monoxide. Prototype electrochemical sensors were fabricated and tested under a variety of environmental conditions. The sensor can measure carbon monoxide concentrations of greater than 10 ppm in both ambient air and directly in flue gases. A microprocessor based electronic circuitry was designed to allow totally automated operation of the instrument. GRA

N87-14673*# National Aeronautics and Space Administration, Washington, D.C.
STUDY OF DOUBLE EXPOSURE HOLOGRAPHY OF THE 3-DIMENSIONAL CHARACTER OF THE FLOW AROUND AN AIRFOIL PROFILE IN A WIND TUNNEL
G. Heid and M. Stanislas Sep. 1986 39 p Transl. into ENGLISH of "Etude par Holographi a Double Exposition du Caractere Tridimensionnel de lEcoulement Autour dUn Profil dAile en Souffierie" Lille, France, 3 Jul. 1980 p 1-34 Translation was announced as N82-22474 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Inst. de Mecanique des Fluides de Lille, France
(Contract NASw-4005)
(NASA-TM-88486; NAS 1.15:88486; Rept-80/31) Avail: NTIS HC A02/MF A01 CSCL 82B

The tridimensional character of the flow around a profile placed between walls is demonstrated and the incidence induced with the assistance of measurements of velocities by double exposure holography is evaluated. The values obtained by the theory of Menard are compared satisfactorily to the values obtained by this experiment. E.R.

N87-14674*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SPACELAB LYMAN ALPHA-WHITE LIGHT CORONAGRAPH PROGRAM Final Report, 12 Mar. 1980 - 1 Oct. 1983
John L. Kohl Jun. 1986 32 p
(Contract NAS5-26079)
(NASA-CR-177902; NAS 1.26:177902) Avail: NTIS HC A03/MF A01 CSCL 82B

The Spacelab Lyman Alpha Coronagraph (SLAC) of the Smithsonian Astrophysical Observatory (SAO) and the White Light Coronagraph (WLC) to be provided by the High Altitude Observatory (HAO) are two separate coronagraphs which would be operated in a joint fashion during Spacelab missions to be flown by the Space Shuttle. The two instruments would be used to perform joint observations of solar coronal structures from 1.2 to 8.0 solar radii from sun-center in vacuum ultraviolet and visible radiations. Temperatures, densities, and flow velocities throughout the solar wing acceleration region of the inner solar corona were measured. The Phase I Definition activity resulted in the successful definition and preliminary design of the experiment/instrumentation subsystem and associated software, ground support equipment and interfaces to the extended required to accurately estimate the scope of the investigation and prepare an Investigational Development Plan; the performance of the necessary functional, operations, and safety analyses necessary to complete the Experiment Requirements document. B.G.

N87-14675*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVICE FOR QUICK CHANGEOVER BETWEEN WIND TUNNEL FORCE AND PRESSURE TESTING Patent Application
Richard M. Wood, inventor (to NASA) Filed 28 Aug. 1986 10 p
(NASA-Case-LAR-13512-1; NAS 1.71:LAR-13512-1;
US-Patent-Appl-SN-901113) Avail: NTIS HC A02/MF A01 CSCL 82B

This device allows for expeditious and repeated changeovers between pressure and force testing and which uses a minimum internal volume of a wind tunnel test structure. A matrix configuration of holes is located on the outer surface of the structure. Pressure tubes lead through the internal cavity of the structure from test sites to this outer surface matrix configuration. A pressure tube connector with a corresponding matrix of holes is connected to the surface of the structure. Pressure tubes leading from remotely located transducers are joined to the connector, thus forming pressure passageways from the test sites to the transducers to allow for pressure testing. When force testing is required, the pressure tube connector is disconnected and a cover plate is connected. The cover plate seals the exposed internal pressure tubes. Also, the outer surface of the cover plate conforms to the exterior of the structure, providing the necessary smooth surface for force testing. If further pressure testing is required, the cover plate can be disconnected and the pressure tube connector reconnected. The novelty of this invention resides in the development of a device which allows for an expeditious changeover between wind tunnel force and pressure testing involving numerous test sites while utilizing a minimum internal volume of the test structure. NASA

N87-14676*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACOUSTIC EMISSION FREQUENCY DISCRIMINATION Patent Application
Frank E. Sugg (Rockwell International Corp., Thousand Oaks, Calif.) and Lloyd J. Graham, inventors (to NASA) Filed 12 Jun. 1986 17 p Sponsored by NASA
(NASA-Case-MSC-20467-1; NAS 1.71:MSC-20467-1;
US-Patent-Appl-SN-874319) Avail: NTIS HC A02/MF A01 CSCL 14B

In acoustic emission nondestructive testing, broadband frequency noise is distinguished from narrow banded acoustic emission signals, wherein the latter are valid events indicative of structural flaws in the material being examined. This is accomplished by separating out those signals which contain frequency components both within and beyond (either above or below) the range of valid acoustic emission events. Application to acoustic emission monitoring during nondestructive bond verification and proof loading of undensified tiles on the space shuttle orbiter is considered. NASA

N87-14677# Massachusetts Inst. of Tech., Cambridge. Lincoln Lab.
CALIBRATION OF ETS VIDEOTAPES
A. J. Yakutis, L. G. Taff, and S. Sayer 29 Apr. 1986 26 p
(Contract F19628-85-C-0002)
(AD-A168888; ETS-77; ESD-TR-86-005) Avail: NTIS HC A03/MF A01 CSCL 03/1

This Project Report discusses an attempt to calibrate photometric data acquired from streaks generated by moving objects which were observed at the ETS. This is desirable for both natural and artificial bodies. The utility of a meaningful apparent magnitude from streak data would allow statistical studies of size-albedo distributions, serve as a size indicator in the absence of traditional photometry, and alleviate the difficulties of artificial satellite photometry on the rapidly moving near-Earth population. Unfortunately we have been unsuccessful at this endeavor. Moreover, were this trial successful we can envisage sundry systematic errors that would creep into more widespread applications. Some of these are related to angular speed, field of view, time duration of a streak, frame-to-frame variability, length of streak arc across the field of view, and the angle between the angular velocity and the direction of the video scan lines. This general topic is important and we will pursue other approaches if they can address our apprehensions. Author (GRA)

N87-14678# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
BALLOON INSTRUMENTATION ENGINEERING AND DEVELOPMENT Final Report, 3 May 1982 - 15 Jul. 1985
James D. DeLaurier and Jaap H. DELeeuw 15 Oct. 1985 39 p
(Contract F19628-82-C-0041)
(AD-A170225; AFGL-TR-85-0258) Avail: NTIS HC A03/MF A01 CSCL 01/3

A 3-year balloon instrumentation R&D effort is summarized. Approaches are described and results are given for the seven principal tasks that were successfully carried out: (1) ballast valve redesign; (2) development and refinement of tethered aerostat flight performance computer programs; (3) research into performance characteristics of the standard EV-13 helium valve; (4) development of a ground station and flight components of a balloon tracking system designed to work with the Omega navigational system; (5) the design of an ultra-sensitive high altitude balloon motion sensing package; (6) the development of tethered aerostat instrumentation package; and (7) the rehabilitation of a 45,000 cubic ft ILC Aerostat. It is concluded that the program was highly productive, providing the U.S. Air Force with new instruments and techniques to augment its balloon operational capabilities. GRA

N87-14679# Centre Technique des Industries Mecaniques, Senlis (France).
STUDY AND IMPLEMENTATION OF TORQUE WRENCH CALIBRATING APPARATUS Final Report [ETUDE ET MISE EN PLACE DES MOYENS D'ETALONNAGE DE CLES DYNAMOMETRIQUES]
J. Breut 11 Feb. 1986 24 p In FRENCH
(CETIM-103-480; ETN-86-98449) Avail: NTIS HC A02/MF A01

The calibration of torque wrenches in the ranges less than 5 mN and 1500 to 2500 mN was studied in order to implement a system which follows the French norm NFE 72325. The required accuracy of 1% is obtained using ball bearings, range splitting, and periodic control. Cost factors are discussed. ESA

N87-14680# Institut Franco-Allemand de Recherches, St. Louis (France).
PROGRESS IN HOLOGRAPHIC CINEMATOGRAPHY
P. Smigielski, H. Fagot, and E. Albe 19 Dec. 1986 15 p Presented at 2nd International Technical Symposium on Optical and Electro-Optical Applied Science and Engineering. Progress in Holographic Applications, Cannes, France, 2-6 Dec. 1985 Sponsored by the European Photonic Association
(ISL-CO-243/85; ETN-86-98409) Avail: NTIS HC A02/MF A01

Single exposure cineholograms of living bodies were recorded on a 126-mm film, at a frequency of 25 holograms/sec. Limitations of 3-D movies by holography are described. Double-exposure cineholograms of reflecting objects, a loudspeaker membrane and the vertex cranii of a bald-headed man were recorded. The experiments show the interest of interferometric cineholography for industrial applications. ESA

N87-14681# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
FORCE SENSOR BASED ON THE MAGNETOELASTIC EFFECT Thesis
J. Troost Dec. 1984 125 p In DUTCH; ENGLISH summary
(ETN-86-98719) Avail: NTIS HC A06/MF A01

A simple, robust, and accurate force sensor was developed. Various principles, such as measurement of the length of the deformation, piezoelectric force sensors, force sensors using strain gages, and magnetoelastic force sensors are discussed. The theoretical and practical backgrounds of force sensors based on the magnetoelastic effect are explained. The mechanical construction was determined using the finite element method. The factors governing the choice of materials were determined. Several indications show that the developed force sensor is very suitable for use in rough environments (e.g., for robots). A better mechanical measuring apparatus is needed to find out how accurate the force sensor really is. The expectation is that an accuracy better than 0.5% can be reached. ESA

N87-14682# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Systemtechnik und Navigation.
LABORATORY TESTS OF THE SENSORS OF THE STEINHEIL-LEAR SIEGLER STRAPDOWN MEASUREMENT UNIT MODEL 1903-SB FOR MODEL ATTITUDE MEASUREMENTS IN A WIND TUNNEL
Volker Wetzig and Egmar Luebeck Apr. 1986 68 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-86-15; ISSN-0176-7739; ETN-86-98753) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 26

Laboratory tests of the sensors for the Model Attitude Measurement System (MAMS) were performed. The sensor units, the test equipment, and the data acquisition are discussed. The sensor tests included rate tests for the investigation of the gyroscope scale factors and measuring axis misalignments, multiposition tests to determine constant and g-dependent gyroscope drift and to calibrate accelerometers, as well as stability tests to evaluate gyroscope drift variations. The results are given in tables with coefficients for error compensation, and with indications concerning short and longterm variations of the coefficients and measured values. ESA

N87-14683# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Werner-Heisenberg-Inst. fuer Physik.
NEW DETECTOR CONCEPTS
J. Kemmer and G. Lutz Jul. 1986 40 p Presented at the 4th European Symposium on Semiconductor Detectors, Munich, West Germany, 3-5 Mar. 1985
(MPE-PAE/Exp-E1-164; ETN-87-98873) Avail: NTIS HC A03/MF A01

Semiconductor drift chamber detectors which enable the determination of energy, energy loss, position, and penetration depth of radiation are proposed. An integrated transistor-detector configuration allows nondestructive repeated readout and amplification of the signal. The detectors include large area low capacity photodiode dE/E-detectors and CCD structures. It is shown that the charge of majority carriers, which is collected in the potential maximum (PM) may change the conductance behavior of nearby integrated transistors and enable direct amplification of the signal. A matrix pixel device based on this structure is proposed. The PM can shield electronic components against charge carriers from the bulk. ESA

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N87-14684# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
RESONATOR INTERNAL ABSORPTION AND NONLINEAR DYNAMICS OF MULTIMODE LASER SYSTEMS [RESONATOR-INTERNE ABSORPTION UND NICHTLINEARE DYNAMIK VON MULTIMODE-LASERSYSTEMEN]
Harald Atmanspacher May 1986 125 p In GERMAN
(MPE-197; ISSN-0178-0719; ETN-86-98259) Avail: NTIS HC A06/MF A01

The time dependent behavior of a CW multimode dye laser with resonator-internal absorber was investigated. The dynamic behavior of a linear CW multimode laser was analyzed. For individual titles, see N87-14685 through N87-14686.

N87-14685# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
RESONATOR INTERNAL ABSORPTION [RESONATORINTERNE-ABSORPTION]
Harald Atmanspacher *In its* Resonator Internal Absorption and Nonlinear Dynamics of Multimode Laser Systems May 1986 62 p In GERMAN (For primary document see N87-14684 06-36)
Avail: NTIS HC A06/MF A01

Time dependent behavior of a CW multimode dye laser with resonator internal absorber was investigated. A rate equation assumption which takes into account the effect of saturation in the case of high absorption coefficients was used. Stochastic Langevin forces which lead to substantial intensity fluctuations in the single modes were considered. The lifetime of single modes depends on the spectral power density in the resonator through these fluctuations. It is shown that the sensitivity of the absorption depends on the mode lifetime, and can be described by a modified Beer law. The case of saturated absorption of I2 was quantitatively measured with a method for small absorption coefficients. The different mechanisms which determine the sensitivity of the absorption are discussed. Resonator internal double resonance in the visible range was demonstrated in atmospheric H2O. ESA

N87-14686# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DYNAMICS OF MULTIMODE LASERS [DYNAMIK VON MULTIM-ODE-LASERN]
Harald Atmanspachner *In its* Resonator Internal Absorption and Nonlinear Dynamics of Multimode Laser Systems May 1986 p 62-114 In GERMAN (For primary document see N87-14684 06-36)
Avail: NTIS HC A06/MF A01

The dynamic behavior of a linear CW multimode laser was analyzed. The correlation times of the mode amplitudes, the fractal dimensionality of the system, and the Kolmogorov entropy were measured in dependence on the spectral power density in the resonator. Experimental results show that stochastic and chaotic processes are superposed. At low spectral power densities, instabilities accompanied by a drastic reduction of the mode correlation times and a discontinuous change of the fractal dimensionality and the Kolmogorov entropy are observed. These instabilities are interpreted as transitions between chaotic attractors. At high spectral power densities the mode correlation time reaches a constant value, and stochastic processes dominate. ESA

N87-14687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOSCIENCE LASER ALTIMETRY/RANGING SYSTEM (GLARS)
Steven C. Cohen, John J. Degnan, Jack L. Bufton, James B. Garvin, and James B. Abshire Sep. 1986 19 p
(NASA-TM-87803; Rept-87B0018; NAS 1.15:87803) Avail: NTIS HC A02/MF A01 CSCL 20E

The Geoscience Laser Altimetry Ranging System (GLARS) is a highly precise distance measurement system to be used for making extremely accurate geodetic observations from a space platform. It combines the attributes of a pointable laser ranging system making observations to cube corner retroreflectors placed on the ground with those of a nadir looking laser altimeter making height observations to ground, ice sheet, and oceanic surfaces. In the ranging mode, centimeter-level precise baseline and station coordinate determinations will be made on grids consisting of 100 to 200 targets separated by distances from a few tens of kilometers to about 1000 km. These measurements will be used for studies of seismic zone crustal deformations and tectonic plate motions. Ranging measurements will also be made to a coarser, but globally distributed array of retroreflectors for both precise geodetic and orbit determination applications. In the altimetric mode, relative height determinations will be obtained with approximately decimeter vertical precision and 70 to 100 meter horizontal resolution. The height data will be used to study surface topography and roughness, ice sheet and lava flow thickness, and ocean dynamics. Waveform digitization will provide a measure of the vertical extent of topography within each footprint. The planned Earth Observing System is an attractive candidate platform for GLARS since the GLAR data can be used both for direct analyses and for highly precise orbit determination needed in the reduction of data from other sensors on the multi-instrument platform. (1064, 532, and 355 nm)Nd:YAG laser meets the performance specifications for the system. Author

N87-14688# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE STATUS OF ROTATIONAL NONEQUILIBRIUM IN HF CHEMICAL LASERS
N. Cohen, J. F. Bott, M. A. Kwok, and R. L. Wilkins 1 May 1986 75 p
(Contract F04701-85-C-0086)
(AD-A169436; TR-0086(6603)-2; SD-TR-86-26) Avail: NTIS HC A04/MF A01 CSCL 20/5

Because of the complexity of accounting simultaneously for gas dynamics, optics, and chemical kinetics in HF chemical lasers, all computer modeling codes have simplified drastically at least one of these factors. One way to simplify the details of state to state chemistry is to ignore the possibility of rotational nonequilibrium. Rotational nonequilibrium can affect laser power and energy output, time to onset and duration of lasing, and power spectral distribution. This report will review, in turn, evidence for rotational nonequilibrium in HF chemical lasers; processes that can lead to rotational nonequilibrium in HF lasers; rotational relaxation of HF; and modeling studies of rotational nonequilibrium effects in HF chemical lasers. GRA

N87-14689# TRW, Inc., Redondo Beach, Calif. Applied Technology Div.
PHASED ARRAY LASER SYSTEM (PALS) Final Report, Jul. 1985 - Jul. 1986
Alvin D. Schnurr, S. Meisenholder, M. Litvak, S. Quon, and G. Koop 9 Jul. 1986 148 p
(Contract N00014-85-C-2338)
(AD-A169635) Avail: NTIS HC A07/MF A01 CSCL 20/5

This final report for the Phased Array Laser System (PALS) project presents analyses and design approaches for a high brightness space based HF phase conjugate laser system answering current SDI needs. These efforts are first steps toward a conceptual design for an SDI SBL system with substantial advantages over conventional non phase conjugate systems. The analyses deal with the master oscillator, power amplifier, phase conjugation and beam director subsystems. ALPHA type devices comprising the MOPA are modeled with the ANOM/CLAM/LFCM codes. The assembly for separating the high power conjugated beam from the low power master oscillator beam is modeled with a French polarization grating code and U of Arizona and OCLI quarter-wave retarder codes. A phase-conjugator SBS cell with 40-atm xenon is modeled with BOUNCE/BRIWON codes. Multisegmented primary and monolithic secondary mirror beam director assemblies are modeled with wave optics codes developed in this project. Subscale experiments on xenon gas and CC14 liquid

SBS phase conjugation explored dependence of SBS reflectivity and conjugation fidelity on parameters such as beam quality degradation by aberrators and on the f/number of the focusing geometry. GRA

N87-14690# RAND Corp., Santa Monica, Calif.
SOVIET DEVELOPMENT OF GYROTRONS Interim Report.
Simon Kassel May 1986 75 p
(Contract MDA903-85-C-0030)
(AD-A169680; RAND/R-3377-ARPA) Avail: NTIS HC A04/MF A01 CSCL 10/2

This report surveys the development of high power cyclotron resonance masers (CRM) and gyrotrons in the Soviet Union, based on Soviet open source literature. It deals with the nature and history of relativistic CRM devices; provides a sequence of the most important issues of gyrotron research and develoment as perceived by Soviet authors; and discusses individual Soviet research groups, the basic organizational units responsible for the CRM and gyrotron research and development. The study suggests, among other things, that high power relativistic microwave electronics is one of the most successful areas of Soviet R&D. It has maintained a consistent record of significant achievements; it has managed to overcome the systemic weakness of the Soviet R&D system in being able to translate effectively the results of advanced research into production of practical equipment; and it has become the fastest growing area of application of pulsed power technology, which itself has been for many years the subject of priority development in the USSR. GRA

N87-14691# City Coll. of the City Univ. of New York. Ultrafast Spectroscopy and Laser Lab.
PICOSECOND AND FEMTOSECOND SPECTROSCOPIC INSTRUMENTATION FOR ULTRAFAST SPECTROSCOPY AND LASERS Final Report, 14 Dec. 1984 - 31 Dec. 1985
Robert R. Alfano 10 Mar. 1986 8 p
(Grant AF-AFOSR-0055-85)
(AD-A170126; AFOSR-86-0498TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The Institute has acquired state-of-the-art ultrafast lasers and diagnostic instrumentation to upgrade its facilities and capabilities. A femtosecond mode locked CPM dye laser - dye amplifier system was substantially improved by the addition of new YAG laser pump. This femtosecond system will be used in the study of ultrafast processes in semiconductor microstructures and alloys. A multichannel Raman spectroscopic system was installed for use in the study of transient Raman effect in semiconductors and shock wave induced processes. An ultrafast streak camera was acquired for photoluminescence kinetic studies in semiconductor alloys and microstructures with a time resolution of 2 ps. GRA

N87-14692# University of Southern California, Los Angeles.
A PRECISION LASER SPECTROMETER SYSTEM Final Report, 15 Aug. 1983 - 31 Aug. 1984
Martin Gundersen, Hanna Reisler, and Curt Wittig 1 Apr. 1986 13 p
(Grant AF-AFOSR-0306-83)
(AD-A170226; AFOSR-86-0356TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

An excimer laser based dye laser system has been purchased and integrated into experiments which involve DOD funding. The laser system is currently used in several important experiments: photodissociation of aliphatic nitro and nitroso alkanes, and halogen cyanides; bimolecular reactions of C2H, and cluster reactions of H with CO2; laser induced influorescence studies in pulsed power switches such as thyratrons. The laser system has already become an integral part of these studies, and will be used in other funded research in the future. GRA

N87-14693# Defence Research Establishment Valcartier Quebec).
MEASUREMENT OF THE FREQUENCY SHIFT AT THE PEAK OF THE P20 LINE OF A CO2 WAVEGUIDE LASER
D. Vincent, M. Richard, and G. Otis Jun. 1986 31 p In FRENCH; ENGLISH abstract
(AD-A170318; DREV-4419/86) Avail: NTIS HC A03/MF A01 CSCL 20/5

The concept of a column-reduced polynomial matrix is an important one in the theory of linear systems. The theory of Jordan chains and minimal realization is developed for such matrices. Also, the relationships between generalized latent vectors of the nonsingular polynomial matrix and their associated generalized eigenvectors of the system map are explored in this paper. This permits the spectral analysis of an arbitrary nonsingular polynomial matrix, extending previous work for the monic case. Author (GRA)

N87-14694# Department of the Navy, Washington, D. C.
MINIMUM INDUCTANCE LASER HEAD FOR PULSED TRANSVERSE DISCHARGES WITHOUT WALL TRACKING Patent Application
John D. Shipman and Bernard L. Wexler, inventors (to Navy) Filed 15 May 1986 26 p
(AD-D012429; US-Patent-Appl-SN-863285) Avail: NTIS HC A03/MF A01 CSCL 20/5

This patent application relates to transverse discharge devices and particularly to such devices for use with lasers. Discharge devices used in excimer gas lasers have had two slab electrodes connected to a power supply by means of two separate current carrying members disposed outside the device housing containing the slab electrodes. One member runs from one device electrode down along both sides of the device while another member runs from another device electrode with both members running beyond the last mentioned electrode. This device geometry involves power feed to the electrodes along a path that has an adverse effect on an electric field formed between the device electrodes in the discharge region. Such a device is called a transverse discharge device because the discharge between the electrodes is transverse to the device's optical axis. GRA

N87-14695# Coast Guard Research and Development Center, Groton, Conn.
AN EVALUATION OF THE HYPOTHESIS THAT LASER LIGHT IS MORE CONSPICUOUS THAN INCANDESCENT LIGHT Final Report
T. S. Winslow and M. B. Mandler May 1986 26 p
(AD-A170823; CGR/DC-8/86; USCG-D-16-86) Avail: NTIS HC A03/MF A01 CSCL 17/7

It has been thought that laser aids to navigation might appear more conspicuous than aids employing conventional light sources. Two experiments rigorously tested the hypothesis that laser light is more conspicuous than incandescent light. Incandescent and Helium Neon laser sources were optically filtered and adjusted to present the same illuminance and color to distant observers. Thirty-seven observers viewed 60 random presentations (2 source types, 2 illuminance levels) from a distance of 1500 yards. Group correct source discrimination percentages were 52.6 and 55.2 for the low and high illuminance levels, respectively. The experiment was repeated indoors at higher illuminances with resultant group correct source discrimination percentages of 57, 67.5, and 66 for the low, medium, and high illuminances, respectively. It was concluded that at practical design illuminance levels, no significant conspicuity advantage would be gained by replacing existing navigational aids with laser aids-to-navigation. Calculations show that a significant conspicuity advantage is likely to be obtained if the mariner uses a narrow bandpass filter (3 to 10 nm) centered at the laser wavelength. The illuminance from the laser will be relatively unaffected, while the illuminances from all background lights will be dramatically diminished. An additional section compares the electrical efficiency of a standard Coast Guard FA-240 range light with a laser aid configured for the same application. For equal input power, the FA-240 is shown to produce 10 times the luminous intensity of the laser aid. GRA

N87-14696# KMS Fusion, Inc., Ann Arbor, Mich.
TWO-STAGE FEL (FREE ELECTRON LASER) RESEARCH AT KMS FUSION, INC. Final Report
Stephen B. Segall, S. VonLaven, M. S. Curtin, P. Diament, and J.

F. Ward 14 Jul. 1986 39 p
(Contract N00014-85-C-0278)
(AD-A170828; KMSF-U1766) Avail: NTIS HC A03/MF A01 CSCL 20/5

The basic concept and constraints on two stage free electron lasers are summarized, and the two stage FEL design employing a helical wiggler and quasioptical cavity is described. Recent work is reviewed in the areas of cavity design, modeling of the field of a permanent magnet helical wiggler, fabrication and calibration of permanent magnet dipole rings, and electrostatic accelerator design. A list of publications resulting from this project is given in the references. GRA

N87-14697# Stanford Univ., Calif. Lab. of Physics.
LASER PHYSICS AND LASER TECHNIQUES Final Report, 1 Mar. 1984 - 28 Feb. 1986
A. E. Siegman 19 May 1986 7 p
(Contract F49620-84-C-0041)
(AD-A171949; AFOSR-86-0723TR) Avail: NTIS HC A02/MF A01 CSCL 14/2

This program develops new technologies for exploiting the ultrafast data transmission and measurement capabilities of lasers and applies these new techniques to current scientific problems in physics, chemistry, and ultrafast electronics. Several new techniques are developed for making ultrafast measurements with lasers, both using ultrashort light pulses in combination with novel detection mechanisms to make ultrafast measurements in the time domain, and also using a novel tunable laser induced grating method for making ultrafast measurements without pulses, working in the frequency domain. Using the latter approach, femtosecond resolution frequency domain lifetime measurements are made on chemical systems, including the important optical Kerr material CS. The first picosecond pulse time domain measurements are demonstrated using photoacoustic detection as a sensitive and flexible bulk and surface detection mechanism in liquids and solids flexible, noncontracting method for making picosecond and femtosecond measurements on a very wide variety of surfaces. A number of lifetime and damage studies are made semiconductor surfaces, and the formation of spontaneous surface ripples or stimulated Wood's anomalies are explored picosecond laser pulses. An entirely new ultrafast photodetector concept is invented based on ultrafast diffusion driven charge transport, its experimental demonstration are being persued. GRA

N87-14698# Yale Univ., New Haven, Conn. Dept. of Applied Physics.
INVESTIGATION OF SUPERRADIANT LDV MARKERS AND THREE-COMPONENT VELOCITY MAPPING Annual Report, 1 Jan. - 31 Dec. 1985
Richard K. Chang 21 Jan. 1986 10 p
(Contract F49620-85-K-0002)
(AD-A173066; AFOSR-86-1006TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The major progress in the first year of AROSR support has been made in the area of laser interaction with micron-size droplets flowing in a linear stream. Motivated by our interest in finding bright fluorescent markers for LDV instruments, we have continued the study of lasing droplets. Magnified photographs of lasing droplets reveal that the laser radiation is confined just within the liquid-air interface, whether the actual droplet shape is spherical or spheroidal. The possibility of providing chemical species identification of liquid droplets from the nonlinear optical spectra of droplets led us to investigate the stimulated Raman scattering, coherent anti-stokes Raman scattering, and coherent Raman mixing processes within the droplets. Progress in these areas is described. Considerable effort was devoted to developing an optical technique which has the potential of providing three-component velocity mapping in three dimensions. Double-pulse holographic experiments are currently under way with seeded particles in a cold flow. The observed particle tracks are being analyzed by a no vel application of the Hough transform which is well known in the pattern recognition field. Progress in this area is also discussed. GRA

N87-14699# Texas Univ., Dallas.
ACTIVITIES OF THE 1ST INTERNATIONAL LASER SCIENCE CONFERENCE Final Report, 15 Jul. 1983 - 14 Jun. 1986
Carl B. Collins Sep. 1986 6 p Conference held in Dallas, Tex., 18-22 Nov. 1985
(Grant DAAG29-85-G-0122)
(AD-A173080; ARO-23043.1-PH-CF) Avail: NTIS HC A02/MF A01 CSCL 20/5

Because of the high standards imposed by the Organizing and Program Committees upon the acceptance of papers, this conference provided an optimal format for the dissemination of results in laser science among workers in the field, many of whom are Army Contractors. A compact and profound perception was presented of the state of the art which lies at the nucleus of many applications that are also on interest to the Army. Moreover, participation enable Contractors to obtain a professional critique of their own efforts as they became more aware of the field in which they work. GRA

N87-14700# Los Alamos National Lab., N. Mex.
ZEEMAN LASER SCATTERING (ZLS): A NEW LIGHT SCATTERING TECHNIQUE
R. G. Johnston, S. B. Singham, and G. C. Salzman 1986 11 p Presented at the International School of Pure and Applied Biostructure, Erice, Italy, 22 Jun. 1986
(Contract W-7405-eng-36)
(DE86-012443; LA-UR-86-2178; CONF-8606154-1) Avail: NTIS HC A02/MF A01

A new light scattering technique, called Zeeman Laser Scattering (ZLS), which uses a two-frequency Zeeman effect laser, is described. The Zeeman effect laser produces two coherent, colinear laser beams having orthogonal polarizations. The laser output is passed unfocused through a scattering cell containing the sample of interest, and the light scattered at each scattering angle is detected with a photomultiplier tube mounted on an arm that rotates under computer control about the scattering cell. The phase and amplitude of the beats produced by the interference of the two colinear laser beams are measured. Three different scattering mechanisms to which ZLS is sensitive are described, and the quantitative theory of ZLS is derived from the scattering amplitude matrix formalism. Samples of ZLS data are given. DOE

N87-14701# Bonn Univ. (West Germany). Inst. fuer Geodaesie.
MODELS FOR THE PREDICTION OF POLAR COORDINATES OF LUNAR REFLECTORS IN THE DYNAMIC EARTH-MOON SYSTEM Ph.D. Thesis [MODELLE ZUR PRAEDIKTION VON POLARKOORDINATEN FUER DIE MONDREFLEKTOREN IM DYNAMISCHEN ERDE-MOND-SYSTEM]
Bernd-Dieter Teichert 1985 125 p In GERMAN
(Rept-69; ISSN-0723-4325; ETN-87-98733) Avail: NTIS HC A06/MF A01

Two models for the prediction of polar coordinates of reflectors installed on the Moon were investigated with respect to their usefulness for Lunar Laser Ranging (LLR). The first model is purely mechanical-analytical, and is based on the Brown Moon theory and on the Moon rotation and libration theory. The second method applies recursive filter algorithms using Kalman filtering. Data from laser ranging measurements were compared with data obtained with both models. Both models fulfil the required accuracy, and are more or less equivalent, with respect to the accuracy of the predictions of azimuth and elevation. However, for range, the Kalman filtering method is preferable. The FORTRAN computer programs for the Kalman filtering are enclosed. ESA

N87-14702# European Space Agency, Paris (France).
INVESTIGATIONS ON LASER MIRRORS OF DIFFERING COATING STRUCTURE
Rolf Gauert and Helmut Rosteck Aug. 1986 41 p Original language document was announced as N86-31887
(ESA-TT-991; DFVLR-FB-85-65; ETN-87-98892) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany DM 17

Laser mirror reflectivity and integral backscattering were investigated. Mirrors were industrially fabricated, or were developed at DFVLR and have ZnS/MgF2 or Ag/ZnS/MgF2 interference coatings. The experimental mirror-coating machine was modified to get reproducible mirrors. The substrate holder was reconstructed so that privileged directions in the layer combination are suppressed. The measurement of the transmissibility during the coating process was carried out at an angle of incidence of 30 deg arc with a built in deflection device. An IR heating device mounted into the machine enabled temperature of the substrates and the substrate holder to rise to 130C. The effects limiting the mirror parameters, such as substrate temperature, impurities on the substrate surfaces and evaporation speed, are discussed. The measurements show that substrate heating of ZnS/MF2 coatings provide hard and stable layers; the use of Ag/ZnS/MgF2 layer combinations increases the reflectivity by 0.1%. ESA

N87-14332# Stuttgart Univ. (West Germany). Inst. fuer Aero- und Gasdynamik.
INTERFEROMETRY [INTERFEROMETRIE]
Guenther Schwarz *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 1-24 In GERMAN Previously announced as N83-34823 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N87-14703*# Dynamic Research, Inc., Torrance, Calif.
SUPPLEMENTARY REPORT ON ANTILOCK ANALYSES
J. W. Zellner Sep. 1985 52 p Sponsored by NASA
(NASA-CR-179955; JPL-Pub-9950-1184; NAS 1.26:179955; DRI-TM-85-12) Avail: NTIS HC A04/MF A01 CSCL 13I

Generic modulator analysis was performed to quantify the effects of dump and reapply pressure rates on antilock stability and performance. Analysis will include dump and reapply rates, and lumped modulator delay. Based on the results of the generic modulator analysis and earlier toggle optimization analysis (with Mitsubishi modulator), a recommended preliminary antilock design was synthesized and its response and performance simulated. The results of these analyses are documented. B.G.

N87-14704*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ACTIVE HOLD-DOWN FOR HEAT TREATING Patent Application
Earl R. Collins, Jr., inventor (to NASA) Filed 21 Oct. 1986 12 p (Contract NAS7-918)
(NASA-Case-NPO-16892-1-CU; NAS 1.71:NPO-16892-1-CU; US-Patent-Appl-SN-921573) Avail: NTIS HC A02/MF A01 CSCL 13I

The object of the disclosure is to provide a vacuum hold-down for holding thin sheets to a support surface, which permits the thin sheet to change dimensions as it is held down. The hold-down includes numerous holes in the support surface, through which a vacuum is applied from a vacuum source. The holes are arranged in zones. The vacuum is repeatedly interrupted at only one or a few zones, while it continues to be applied to other zones, to allow the workpiece to creep along that interrupted zone. The vacuum to different zones is interrupted at different times, as by a slowly turning valve number, to allow each zone of the workpiece to creep. A positive pressure may be applied from a pressured air source to a zone when the vacuum is interrupted there, to help lift the corresponding workpiece zone off the surface to aid in creeping. The workpiece may undergo dimensional changes because of heating, cooling, drying, or other procedure. NASA

N87-14705*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PASSIVELY ACTIVATED PREHENSILE DIGIT FOR A ROBOTIC END EFFECTOR Patent Application
Earl R. Collins, Jr., inventor (to NASA) Filed 21 Oct. 1986 14 p (Contract NAS7-918)
(NASA-Case-NPO-16766-1-CU; NAS 1.71:NPO-16766-1-CU; US-Patent-Appl-SN-921577) Avail: NTIS HC A02/MF A01 CSCL 13I

A common hydraulic reservoir holds one or more rows of slidable pistons or fingers in a base or hand. The individual fingers in each row expose graduated cross-sectional fluid application areas to the hydraulic fluid in the reservoir, with the smallest fluid application area in the center of the row and graduating to progressive larger fluid areas towards both ends of each row. The fingers are elongated pistons. Exposed outer ends of each piston extending away from the reservoir, house a transverse pad to contact an object to be held. The transverse pads are universally ball-joint and spring-center mounted in a longitudinally located opening at the outer tapered end of each finger. Simple and effective capacitance metering in the reservoir is provided for each finger. NASA

N87-14706# Oak Ridge National Lab., Tenn.
REMOTE OPERATION AND MAINTENANCE DEMONSTRATION FACILITY AT THE OAK RIDGE NATIONAL LABORATORY
T. W. Burgess 1986 23 p Presented at the International Meeting on Low, Intermediate and High Level Waste Management Decontamination and Decommissioning, Niagara Falls, N.Y., 14 Sep. 1986
(Contract DE-AC05-84OR-21400)
(DE86-012621; CONF-860905-6) Avail: NTIS HC A02/MF A01

The Remote Operation and Maintenance Demonstration (ROMD) Facility at the Oak Ridge National Laboratory has been developed by the Consolidated Fuel Reprocessing Program to demonstrate remote handling concepts on advanced nuclear fuel reprocessing equipment and for other programs of national interest. The ROMD facility is a large-volume high-bay area that encloses a complete, technologically advanced remote maintenance system and full-scale development reprocessing equipment. The maintenance system consists of a full complement of teleoperated manipulators, manipulator transport systems, and overhead hoists that provide the capability of performing a large variety of remote handling tasks. This system has been used to demonstrate remote manipulation techniques for the US Department of Energy (DOE), the Power Reactor and Nuclear Fuels Development Corporation of Japan, the US Navy, and the National Aeronautics and Space Administration. Extensive tests of manipulative systems and remote maintainability of process equipment have been performed. This paper describes the ROMD facility and key remote maintenance equipment and presents a summary of major experimental activities. DOE

N87-14707# Westinghouse Electric Corp., West Mifflin, Pa.
IN SITU REPAIR OF A FAILED COMPRESSION FITTING Patent Application
R. R. Wolbert, inventor (to DOE) and W. G. Jandrasits, inventor (to DOE) Filed Aug. 1985 14 p
(Contract DE-AC11-76PN-00014)
(DE86-013682; US-Patent-Appl-SN-762489) Avail: NTIS HC A02/MF A01

A method and apparatus for the in situ repair of a failed compression fitting is provided. Initially, a portion of a guide tube is inserted coaxially in the bore of the compression fitting and locked therein. A close fit dethreading device is then coaxially mounted on the guide tube to cut the threads from the fitting. Thereafter, the dethreading device and guide tube are removed and a new fitting is inserted onto the dethreaded fitting with the body of the new fitting overlaying the dethreaded portion. Finally, the main body of the new fitting is welded to the main body of the old fitting whereby a new threaded portion of the replacement fitting is precisely coaxial with the old threaded portion. If needed, a bushing is located on the dethreaded portion which is sized to fit snugly between the dethreaded portion and the new fitting. Preferably, the dethreading device includes a cutting tool which is

moved incrementally in a radial direction whereby the threads are cut from the threaded portion of the failed fitting in increments.
DOE

N87-14708# SEP Gesellschaft fuer Technische Studien, Entwicklung, Planung m.b.H., Munich (West Germany).
DEVELOPMENT AND TESTING OF A WASHING PROCESS FOR EXHAUST GAS OF STATIONARY OPERATED INTERNAL COMBUSTION ENGINES Final Report, Jun. 1984
Rainer Coutelle, Rainer Huss, and Hans-Juergen Wimberger Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 154 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-011; ISSN-0340-7608; ETN-86-98290) Avail: NTIS HC A08/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 32

An exhaust gas washer for stationary operated diesel engines was developed and tested in combination with a heat pump. The exhaust gas is washed with its own condensate in a packed column. The condensate circulation is performed by mammoth pumps. Polluant emission is reduced, depending on operating conditions (speed, temperature, pH of the condensate) by: HC by 30% to 85%, aldehydes by 35% to 99%, phenoles by 50% to 80%, PAH by 80% to 95%, soot by 25% to 70%, SO2 by 65% to 90%, NOx by 5% to 20%. It is possible to reduce the NOx emissions by 75% at little increased fuel consumption by recycling exhaust gases. But higher soot emissions have to be accepted in this case. The condensate is completely degradable in a septic tank after being mixed with waste water containing phosphate.
ESA

N87-14709# Centre Technique des Industries Mecaniques, St. Etienne (France).
ANALYSIS OF SOME ASPECTS OF MECHANICAL MANUFACTURING AUTOMATION Final Report [LE POINT SUR QUELQUES ASPECTS DE L'AUTOMATISATION DES FABRICATIONS MECANIQUES]
J. F. Coudurier, J. P. Devimeux, B. Hoessler, M. Jubin, P. Pontier, B. Ventron, C. Munier, and R. Josserand 17 Mar. 1986 284 p In FRENCH
(CETIM-102700; ETN-86-98444) Avail: NTIS HC A13/MF A01

The industrial applications of robots and automata, the implementation of machining procedures with numerical control systems, and the safety aspects of automation are reviewed. The analysis includes hardware classification, automata programming, workshop organization, viability and cost comparisons, and safety considerations. It is shown that while technical requirements are satisfied, the necessary safety level is not assured. Potential accidents should be studied in more detail to reach an optimum equilibrium between programmed or cabled control and safety.
ESA

N87-14710# Centre Technique des Industries Mecaniques, Senlis (France).
TOOLS FOR HIGH VELOCITY SURFACE MILLING OF STEELS Final Report [OUTILS POUR FRAISAGE SURFACAGE GRANDE VITESSE DES ACIERS]
J. SaintChely, M. Lefebvre, and P. Cherry Mar. 1986 159 p In FRENCH
(CETIM-106030; ETN-86-98450) Avail: NTIS HC A08/MF A01

Operation parameters affecting tool life were studied. Tests were carried out using XC48 mild steel and tool materials such as Al2O3, Al2O3+TiC, silicon nitride, and cubic boron nitride. Tool wear was monitored using a scanning electron microscope. The best results are obtained using alumina ceramics while silicon carbide tools present the performance. The experiments show that the machined volume flow is increased 5 times, but the total volume machined is reduced to 20%.
ESA

N87-14711# Bayer A.G., Dormagen (West Germany). Ing.-Abt. Angewandte Physik Verfahrensentwicklung.
INVESTIGATION OF THE INFLUENCE OF THE IMPACT FRICTION COEFFICIENT ON PNEUMATIC CONVEYING (FRICTION PRESSURE LOSS (FPL) 304) Final Report, Apr. 1984
Franz Nemeck Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 74 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-86-009; ISSN-0170-1339; ETN-86-98762) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15.50

The impact friction coefficients of solid particles on the pipe wall, used for the design of pneumatic conveyors were studied. For measurement in simulated zero-gravity in a bent tube and under condition of real zero-gravity in space, experimental devices were developed. A measuring apparatus for the installation on the MBB-satellite SPAS-01 was flown on STS 7 and STS 11. The collected data were decoded and can be evaluated.
ESA

N87-14712# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE DYNAMIC BEHAVIOR OF AN INDUSTRIAL ROBOT WITH TWO DEGREES OF FREEDOM Thesis
Jacques W. F. M. Beljaars Dec. 1984 101 p In DUTCH; ENGLISH summary
(ETN-86-98722) Avail: NTIS HC A06/MF A01

The dynamic behavior of an industrial robot was examined in an investigation of the possibilities of flexible automation using industrial robots. The dynamic behavior of an industrial robot with two degrees of freedom is mainly determined by the description of the separate degrees of freedom. The parameters of the model describing this behavior can become variables when more degrees of freedom are added. The moment of inertia of the load is the most important variable. The parameter representing the torsional rigidity in the model can be variable. Centrifugal forces are negligible, but Coriolis forces have to be takes into account. Gravitation influences only the quasi static behavior.
ESA

N87-14713# Daimler-Benz A.G., Stuttgart (West Germany).
POSSIBILITIES AND PROBLEMS OF THE CALCULATION OF FLOW PHENOMENA IN COMBUSTION CHAMBERS [MOEGLICHKEITEN UND PROBLEME BEI DER BERECHNUNG VON STROEMUNGVORGAENGEN IN BRENNRAEUMEN]
H.-P. Holzt 25 Aug. 1986 32 p In GERMAN
(ETN-86-98745) Avail: NTIS HC A03/MF A01

Complex flow phenomena in the combustion chamber of a piston motor and its channels were investigated. The significance of the internal cylindrical flow on the motor processes is explained. A model of motor processes is outlined. The measurement and evaluation of turbulence, the determination of the characteristic turbulent measure, and the numerical treatment of turbulence are presented. The modeling of turbulence with the large eddy simulation and the modeling of the boundaries of the cylindrical flow are explained. Due to the strong nonlinearity and the complicated initial and boundary conditions the flow equation system can only be solved numerically.
ESA

N87-14714# Technische Hogeschool, Delft (Netherlands).
THE INFLUENCE OF A NUMBER OF WELDING PARAMETERS ON THE SOLIDIFICATION STRUCTURE OF TUNGSTEN-INERT-GAS (TIG) WELDED ALUMINUM ALLOYS Thesis [DE INVLOED VAN EEN AANTAL LASPARAMETERS OP DE STOLSTRUCTUUR VAN TIG-GELASTE ALUMINIUMLEGERINGEN]
B. T. J. Stoop Nov. 1985 64 p In DUTCH; ENGLISH summary
(ETN-87-98695) Avail: NTIS HC A04/MF A01

The influence of the welding parameters on the solidification structure of weld metals was investigated. The TIG process without addition of filler metal was applied. The theory of the solidification process is explained. The experimental setup in which X-ray microanalysis is used, is described. By varying the welding current and the travel speed the relation between the macrostructure and the welding process were determined. The cellular or dendritic substructure depends on the solidification velocity, temperature gradient, and material composition. The effects of variations in

welding current and travel speed on the substructure were determined. ESA

N87-14715# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.
PULSED MIG WELDING. TABLES AND FIGURES Thesis [PULS MIG LASSEN. TABELLEN EN FIGUREN]
E. J. Moolhuijsen Aug. 1985 44 p In DUTCH
(ETN-87-98698) Avail: NTIS HC A03/MF A01

Pulsed gas metal arc welding experiments were carried out using a prototype welding machine. The measured data are tabulated. The results are shown in figures and graphs. ESA

N87-14716# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.
PULSED MIG WELDING, TEXT Thesis [PULS MIG LASSEN TEKST]
E. J. Moolhuijsen Aug. 1985 54 p In DUTCH; ENGLISH summary
(ETN-87-98699) Avail: NTIS HC A04/MF A01

Pulsed gas metal arc welding (GMAW) experiments were carried out using a prototype welding machine. The current is periodically increased to a peak value during a given time, during which the electrode material melts. It is shown that there are two critical values of the peak time. If the peak time is shorter than the first critical value, an irregular drop detachment occurs; if it lies between the two critical values, drop detachment occurs during the base current; if it exceeds the second critical value, drop detachment takes place during the peak current. At lower currents (100A) the deposition rate of synchro-pulse welding is twice that of GMAW in the dip transfer mode; at the same current the penetration of pulsed GMAW is 20% higher than GMAW in the dip transfer mode. The synchro-pulse welding is found to be a very reliable process in which no spatter occurs. ESA

N87-14717# European Space Agency, Paris (France).
BALANCING OF A ROD USING A DIGITALLY CONTROLLED ROBOT
Klaus-Peter Sondergeld Feb. 1986 72 p Original language document was announced as N86-15677
(ESA-TT-966; DFVLR-FB-85-41; ETN-87-98818) Avail: NTIS HC A04/MF A01; original Germany version available from DFVLR, Cologne, West Germany DM 25

A digital linear controller based on the ASEA IRB 60 robot was designed for balancing a rod suspended at a cardan. The rod deflection angles were measured with potentiometers on the robot arm. The transmission behavior of the robot was modeled with a linear system of second order with dead times. The controller parameters were determined by sequential linear least squares programming. The theoretical results are confirmed by an experiment which shows the possible balancing of a rod with the robot with respect to the boundary conditions (deflection angle and rod position, oversimplfication of the mathematical robot model, robot arm velocity up to 0.3 m/sec and deflection up to 0.5 m) and with application of a joystick potentiometer. A more accurate identification of the robot model parameters with a suspended pendulum is recommended. ESA

N87-14399# Centre National d'Etudes Spatiales, Paris (France). Direction des Lanceurs.
FLUID DYNAMIC PROBLEMS IN THE HM60 (VULCAIN) CRYOGENIC TURBOPUMP
G. Albano and P. Pempie *In* ESA Proceedings of an International Symposium on Fluid Dynamics and Space Aug. 1986 p 41-46 (For primary document see N87-14394 06-18)
Avail: NTIS HC A10/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N87-14718# Arizona Univ., Tucson. Dept. of Mathematics.
ON THE FIRST FAILURE TIME OF DEPENDENT MULTICOMPONENT RELIABILITY SYSTEMS
Moshe Shaked and J. G. Shanthikumar 4 Dec. 1985 30 p
(Grant AF-AFOSR-0205-84)
(AD-A170223; AFOSR-86-0355TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper are considered multicomponent reliability systems where component failure and repair completion rates depend on the state, ages and current repair durations of the other components. This is a generalization of a model of Ross (1984). Sufficient conditions on the sets of rates which imply stochastic ordering between first failure times of two such systems are found. Sufficient conditions on the rates which imply that the first failure time of such a system is new better than used (NBU) are given. Some results of Barlow and Proschan (1976), Chiang and Niu (1980) and Ross (1976) are obtained as special cases. A counterexample to an apparently stronger result of Miller (1979) is also given. Further results and a discussion are included. Author (GRA)

N87-14719# Rockwell International Corp., Golden, Colo.
PROCESS AND APPARATUS FOR SENSING DEFECTS ON A SMOOTH CYLINDRICAL SURFACE IN TUBING Patent Application
G. W. Dutton, inventor (to DOE) Filed Aug. 1985 16 p
(Contract DE-AC04-76DP-03533)
(DE86-013681; US-Patent-Appl-SN-762370) Avail: NTIS HC A02/MF A01

The cylindrical interior surface of small diameter metal tubing is optically inspected to determine surface roughness by passing a slightly divergent light beam to illuminate the entire interior surface of the tubing. Impingement of the input light beam components on any rough spots on the interior surface generates forward and backward scattered radiation components. The forward scattered components can be measured by blocking direct and specular radiation components exiting the tubing while allowing the forward scattered radiation to travel past the blocking location. Collecting optics are employed to converge the forward scattered radiation onto a photodetector generating a signal indicative of surface roughness. In the back scattered mode, back scattered radiation exiting the tubing through the entrance opening is reflected 90 degrees by a beam splitter towards collecting optics and a photodetector. Alternatively, back scattered radiation can be transmitted through a fiber optic bundle towards the collecting optics. The input light beam can be supplied through a white light fiber optic bundle mounted coaxial with the first bundle. DOE

N87-14720# Oak Ridge Y-12 Plant, Tenn.
ANALYTIC SIGNAL CONVERTER FOR NONDESTRUCTIVE TESTING
M. G. Duncan 1986 9 p Presented at the Southeastcon 1986, IEEE Region 3 Conference and Exhibit, Richmond, Va., 23 Mar. 1986
(Contract DE-AC05-84OS-21400)
(DE86-012720; Y/DW-642; CONF-8603139-1) Avail: NTIS HC A02/MF A01

An analytic signal converter was developed to improve flaw detection in parts. The converter can resolve echoes 700 ns apart. The converter operates in real-time by using a single-sideband conversion technique, Weaver's method. The transducer range is 1 to 40 MHz. DOE

N87-14721# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
FAULT DETECTION SENSITIVITY IN THICK LIGHT ALLOY SPECIMENS, TEST REPORT [SENSIBILITE DE DETECTION

DES DEFAUTS DANS LES PIECES EN ALLIAGES LEGERS DE FORTES EPAISSEURS]
G. Hilaire and D. Lecuru 19 Jan. 1986 95 p In FRENCH
(Contract STPA-84-96-010)
(Rept-47-084/F; ETN-86-98429) Avail: NTIS HC A05/MF A01

Crack length detection sensitivity using ultrasonic and Eddy current methods is studied. Cracks around riveted joints in light alloy junctions used in aircraft construction are considered. The detection probability curves were obtained by analyzing the data produced by 11 operators examining 400 rivets using both methods. It is shown that the 95% confidence limit is 3.5 mm for ultrasound and 6 mm for Eddy currents. A multiple inspection using both methods and three operators can eliminate detection errors and assures the detection at a 3.7 mm length. ESA

N87-14722# Centre Technique des Industries Mecaniques, Senlis (France).
EDDY CURRENT AUTOMATION. DISCRIMINATION AND SELECTION SOFTWARE APPLIED TO HARDNESS CONTROL Final Report [AUTOMISATION COURANTS DE FOUCAULT. LOGICIELS DE DISCRIMINATION ET TRI APPLIQUES AU CONTROLE DE DURETE]
G. Wache and P. Moulin Feb. 1986 43 p In FRENCH
(CETIM-100-090; ETN-86-98437) Avail: NTIS HC A03/MF A01

The numerical treatment of eddy current signals applied to the inspection of bolt defects is discussed. The application programs, developed in Basic language include automatic selection procedures. The geometry of the inspected specimens is described. The experimental results obtained when three kinds of bolt quality are mixed show that the inspection is carried out successfully, with an acceptable error risk. ESA

N87-14723# Construcciones Aeronauticas S.A., Madrid (Spain). Investigacion y Desarrollo de Tecnologia y Materiales.
RESULTS OF THE TESTS CARRIED OUT TO STUDY THE PHYSICAL PARAMETERS AFFECTING THE ULTRASONIC INSPECTION MADE BY TRANSMISSION UNDER WATER JET (SIRO), PART 1 [RESULTADOS DE LOS ENSAYOS LLEVADOS A CABO PARA LA PUESTA A PUNTO DE LOS PARAMETROS FISICOS A TENER EN CUENTA EN LA INSPECCION ULTRASONICA POR TRANSMISION BAJO COLUMNAS DE AGUA (SIRO), PT 1]
J. M. Bernardo 30 Sep. 1985 27 p In SPANISH
(I-114/85-Pt-1; ETN-86-98564) Avail: NTIS HC A03/MF A01

Piezoelectric crystal characteristics, nozzle geometry, mechanical parameters of the inspecting robot movement, and water jet parameters for ultrasonic flaw detection were studied. The influence of water jet length and water jet angle were tested. The effects of misalignments were examined. It is shown that a set of nozzles of 3 and 6 mm diameter is better in case of large misalignments; that short jets compatible with specimen dimensions are preferable; and that it is possible to work using different angles, though a 30 deg angle is to be avoided. ESA

N87-14724# Construcciones Aeronauticas S.A., Madrid (Spain). Investigacion y Desarrollo de Tecnologia y Materiales.
RESULTS OF THE TESTS CARRIED OUT TO STUDY THE PHYSICAL PARAMETERS AFFECTING ULTRASONIC INSPECTION MADE BY TRANSMISSION UNDER WATER JETS (SIRO), PART 2 [RESULTADOS DE LOS ENSAYOS LLEVADOS A CABO PARA LA PUESTA A PUNTO DE LOS PARAMETROS FISICOS A TENER EN CUENTA EN LA INSPECCION ULTRASONICA POR TRANSMISION BAJO COLUMNAS DE AGUA (SIRO), PT 2]
E. Garate 21 Oct. 1985 26 p In SPANISH
(I-126/85-Pt-2; ETN-86-98565) Avail: NTIS HC A03/MF A01

The shape of the tube and the configuration of the nozzle which generates the water jet conveying the ultrasonic signal are investigated. Several types of tubes and nozzles were tested using specimens of different shapes. The results show a large influence of tube and nozzle design, with strong signal attenuation in the case of small radius of curvature. ESA

N87-14725# Construcciones Aeronauticas S.A., Madrid (Spain). Investigacion y Desarrollo de Tecnologia y Materiales.
ULTRASONIC INSPECTION OF HINGE SUPPORT NUMBER 5 [INSPECCION ULTRASONICA DEL HINGE SUPPORT 5]
E. Garate 1 Dec. 1985 23 p In SPANISH
(I-129/85; ETN-86-98566) Avail: NTIS HC A02/MF A01

Within a series of tests related to carbon fiber reinforced plastic components of the A-320, a hinge support of the horizontal stability control surface is investigated. Different types of damage were artificially produced and heavy loads were applied. The characteristics of the ultrasonic scanner and color photography code used are described. The results show that the color images give an accurate description of specimen defects. ESA

N87-14726# United Kingdom Atomic Energy Authority, Harwell (England). National NDT Centre.
THE USE OF FREQUENCY AVERAGING TECHNIQUES TO ENHANCE TOFD IMAGES FROM AUSTENITIC WELDS
M. G. Silk, K. F. Bainton, and M. Hillier Mar. 1966 33 p
(AERE-R-12159) Avail: NTIS HC A03/MF A01

A number of frequency averaging approaches have been considered for the enhancement of ultrasonic data obtained from austenitic welds. In particular data obtained using the time-of-flight diffraction (TOFD) technique has been evaluated, but the broad conclusions would apply to any ultrasonic technique. It is shown that a substantial improvement in image quality is possible using particular frequency averaging algorithms. Two austenitic welds containing fatigue cracks have been inspected in this way and clear images of the defects have been obtained in each case. One of these welds was largely uninspectable using TOFD in the normal way. The welds were chosen because they had already been used as the basis of an evaluation of the use of horizontally polarized shear (SH) waves for the inspection of austenite. It is thus possible to compare and contrast these techniques. Possibly the most important conclusion is that, while the two techniques (use of SH waves and frequency averaging) can both be used to inspect these welds, they are complementary and thus could be used together. This combination may provide a very powerful means of inspecting even more difficult austenitic specimens. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N87-14727 National Physical Lab., Teddington (England). Div. of Materials Applications.
THE MODELLING OF CREEP FOR ENGINEERING DESIGN-1
J. C. Ion (Cambridge Univ. (England).), A. Barbosa, M. F. Ashby, B. F. Dyson, and M. Mclean Apr. 1986 66 p
(NPL-DMA-A115; ISSN-0143-7313; ETN-86-98615) Copyright. Avail: Issuing Activity

Ways in which the creep response of metals and ceramics can be expressed in equations suitable for engineering design were studied. A formulation which includes primary and tertiary creep and which is capable of describing histories of loading during which the stress or the temperature change is outlined. The approach leads to the definition of an engineering parameter-set for creep: a set of constants, derivable from the creep curve (or family of curves for different loads and temperatures), which characterize creep and creep fracture for the material. The equations, together with the parameter-set, allow the calculation of creep strain, life, and residual life, for histories of loading under varying conditions. A major unresolved problem is the detailed form of the equations describing the evolution of the internal state variables. A computer package which utilizes this modeling to allow creep strain prediction in engineering alloys subjected to stress and temperature variations was developed. ESA

N87-14728# Australian Atomic Energy Commission, Lucas Heights.
A METHOD AND A DEVICE TO DETERMINE THE CRACK DEPTH OF SURFACE CRACKS
Walter Kaule 1986 23 p Transl. into ENGLISH from West German Patent No. DE-32-17-947-A1 (Cologne, West Germany) (17 Nov. 1983)
(BLL-Trans-AAEC-798-(1797.43)) Avail: British Library Lending Div., Boston Spa, Engl.

The invention is based on the fact, that surface waves have a penetration depth, which is a function of their frequency. For the purpose of determining the depth (T) of surface cracks and ultrasonic surface wave impulse with a broad spectrum is generated in the first instance, preferably with the assistance of a laser. Subsequently, during a transmission measurement, the ultrasonic sound impulse frequency spectrum which has not been cut off by the crack is then determined. Author

N87-14729*# National Aeronautics and Space Administration, Washington, D.C.
ON CONTACT PROBLEMS OF ELASTICITY THEORY
A. I. Kalandiya Oct. 1986 20 p Transl. into ENGLISH from "K Kontaktnym Zadachim Teorii Uprugosti" IN: Prikladnaya Matematika i Mekhanika (Moscow, USSR), v. 21, no. 3, 1957 p 389-398 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88491; NAS 1.15:88491) Avail: NTIS HC A02/MF A01 CSCL 46E

Certain contact problems are reviewed in the two-dimensional theory of elasticity when round bodies touch without friction along most of the boundary and, therefore, Herz' hypothesis on the smallness of the contact area cannot be used. Fundamental equations were derived coinciding externally with the equation in the theory of a finite-span wing with unkown parameter. These equations are solved using Multhopp's well-known technique, and numerical calculations are performed in specific examples. Author

N87-14730*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A LOW-COST OPTICAL DATA ACQUISITION SYSTEM FOR VIBRATION MEASUREMENT
Stephen J. Posta and Gerald V. Brown Dec. 1986 21 p
(NASA-TM-88907; E-3330; NAS 1.15:88907) Avail: NTIS HC A02/MF A01 CSCL 20K

A low cost optical data acquisition system was designed to measure deflection of vibrating rotor blade tips. The basic principle of the new design is to record raw data, which is a set of blade arrival times, in memory and to perform all processing by software following a run. This approach yields a simple and inexpensive system with the least possible hardware. Functional elements of the system were breadboarded and operated satisfactorily during rotor simulations on the bench, and during a data collection run with a two-bladed rotor in the Lewis Research Center Spin Rig. Software was written to demonstrate the sorting and processing of data stored in the system control computer, after retrieval from the data acquisition system. The demonstration produced an accurate graphical display of deflection versus time. Author

N87-14731# Terra Tek, Inc., Salt Lake City, Utah.
STATIC AND DYNAMIC TESTING OF INTERCEPTOR SUBSTRUCTURES Final Report, 1 Dec. 1980 - 30 Apr. 1981
M. L. Wilson and R. H. Todd Mar. 1986 191 p
(Contract DAAG29-81-C-0023)
(AD-A169732; RTRE-82-18; MTL-TR-86-5) Avail: NTIS HC A09/MF A01 CSCL 11/4

Truncated, conical, half-scale, interceptor substructures were tested under axial and shear/bend loads. The substructures, designed and fabricated by General Dynamics, were manufactured with 20 ply boron/aluminum composite tape; each ply was 0.0069 to 0.0080 inch thick. Boron filaments made up 47.0 + or - 3.0 percent of the composite tape. Average substructure dimensions were 5.80 inches (outside) forward diameter, 7.79 inches (outside) base diameter, and 9.112 inches high (total apex angle 12.46). The wall thickness was 0.144 inches. Axial loading (both static and dynamic) as well as shear/bend loading (static only) tests were performed; one sample was tested at each test condition. An upper bound to the failure load under static axial loading was estimated at between 600,000 and 700,000 pounds. Under dynamic axial loading failure was initiated at a defect in the substructure and occurred at 519,000 pounds. Failure load in shear/bend was 44,000 pounds for the load applied laterally 1 inch forward of the truncated nose (bending moment of 383, 300 in-lbs at the built-in section, 1.4. inches above the base of the cone). GRA

N87-14732# Brown Univ., Providence, R. I. Engineering Div.
THE THREE DIMENSIONAL STRESS INTENSITY FACTOR DUE TO THE MOTION OF A LOAD ON THE FACES OF A CRACK
Jean-Claude Ramirez May 1986 38 p
(Contract N00014-85-K-0597; Grant NSF MSM-85-13096)
(AD-A170135) Avail: NTIS HC A03/MF A01 CSCL 20/11

The dynamic stress intensity factor history for a half plane crack in an otherwise unbounded elastic body, with the crack faces subjected to a traction distribution consisting of a pair of point loads that move in a direction perpendicular to the crack edge, is considered. The exact expression for the mode I stress intensity factor as a function of time for any point along the crack edge is obtained by extending a procedure recently introduced by Freund. The method of solution is based on integral transforms methods and the theory of analytic functions of a complex variable. Some features of the solution are discussed and graphical results for various point load speeds are presented. GRA

N87-14733# Army Close Combat Armaments Center, Watervliet, N.Y.
STRESS AND DEFORMATION ANALYSIS OF AUTOFRETTAGED HIGH PRESSURE VESSELS Final Report
P. C. Chen Jun. 1986 27 p
(AD-A170257; ARCCB-TR-86020) Avail: NTIS HC A03/MF A01 CSCL 13/13

A method of stress and deformation analysis based on a new theoretical model is reported. The new model is a close representation of the actual loading/unloading behavior in a high strength steel. Bauschinger effect factor is treated as a function of overstain. The strain-hardening effect is taken into account with different parameters used for loading and unloading processes. The formulas for calculating stresses, strains, and displacements are given and new results of residual stresses in autofrettaged high pressure vessels are presented. Author (GRA)

N87-14734# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
TEARING OF CIRCUMFERENTIAL CRACKS IN PIPES LOADED BY BENDING
J. Lyell Sanders, Jr. May 1986 16 p
(Contract N00014-84-K-0510)
(AD-A170429; MECH-79) Avail: NTIS HC A02/MF A01 CSCL 20/11

The paper develops a theory of tearing for circumferential through-cracks in pipes. Resistance to tearing is postulated to be a consequence of invariance in shape at the tip of a growing crack. GRA

N87-14735# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
MICROMECHANICS 2
Bernard Budiansky Jun. 1986 9 p
(Contract N00014-84-K-0510)
(AD-A170560; MECH-82) Avail: NTIS HC A02/MF A01 CSCL 20/11

Several current studies in the micromechanics of solid bodies are reviewed. As in many such investigation, methods of continuum and structural mechanics are used in the analysis of models at microscopic levels with the aim of increasing understanding of material behavior in the large. The works described herein are concerned with the fracture resistance of toughened ceramics,

the interfacial stress anlaysis of hard particles in ductile metals, and the elastic behavior of lungs. GRA

N87-14736# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
TESTS AND INTERPRETATION OF MIXED MODE 1 AND 2 FULLY PLASTIC FRACTURE FROM SIMULATED WELD DEFECTS
George A. Kardomateas and Frank A. McClintock 31 Jul. 1986 48 p
(Contract N00014-82-K-0025)
(AD-A170644) Avail: NTIS HC A03/MF A01 CSCL 11/6

Most fracture tests use symmetric specimens, with the crack advancing into the relatively undamaged region between two plastic zones. A crack near a weld or shoulder, loaded into the plastic range, may have only a single shear band, however, along which the crack grows into prestrained and damaged material with less ductility than the usual symmetric configurations. Tests on six alloys show that the crack growth ductility, defined as the minimum displacement per unit ligament reduction, is less in the asymmetric case than in the symmetric one by a factor of 3 for low hardening alloys (with strain hardening exponents n = 0.1). This means that with low-hardening (typically high strength) alloys, the surrounding structure must be 3 times stiffer for fracture stable design. For higher hardening alloys (n = 0.23) the crack growth ductility is less in the asymmetric case by a factor of at most 1.2. The crack initiation ductility (here approximately the crack tip displacement CTD) is relatively unaffected by asymmetry, but it cannot always be relied on for ductility, (e.g., in low cycle fatigue). Therefore tests such as these on crack growth ductility are needed for help in design and maintenance of structures. GRA

N87-14737# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
MIXED MODE 1 AND 2 FULLY PLASTIC CRACK GROWTH Summary Report
Frank A. McClintock 31 Jul. 1986 10 p
(Contract N00014-82-K-0025)
(AD-A170645) Avail: NTIS HC A02/MF A01 CSCL 11/6

If a structure cracks, it is desirable that any crack growth be fully plastic to provide large deflections, both for stability by load-shedding to other parts of the structure, and for facilitating crack detection before failure of the entire structure. Unstable fractures are not only serious in themselves, but they may lead to a transition to brittle cleavage fracture that can propagate through parts of the structure that are much more lightly loaded. Materials tests traditionally involve symmetric specimens, in which the crack advances between two slip bands into undamaged material. In practice, asymmetries often occur for cracks near welds, fillets, or shoulders. Then the deformation is focused into a single band, along which the crack advances into pre-damaged material. A measure of fully plastic crack toughness is the crack growth ductility, defined as the extension required (as a fraction of the original ligament) per unit load drop (as a fraction of maximum load). The crack growth ductility thus provides a measure of the stiffness of the surrounding structure that is required for stability of the entire structure. The main result of this work is to show that in typical structural alloys with low strain hardening, asymmetries reduce the crack growth ductility by a factor of two to three. Asymmetries have little effect on the displacement for initiation, or on the crack growth ductility of higher hardening alloys, such as annealed, hot rolled, or normalized steels. GRA

N87-14738# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
SHEAR BAND CHARACTERIZATION OF MIXED MODE 1 AND 2 FULLY PLASTIC CRACK GROWTH
Frank A. McClintock and George A. Kardomateas 31 Jul. 1986 22 p
(Contract N00014-82-K-0025)
(AD-A170646) Avail: NTIS HC A02/MF A01 CSCL 11/6

Fully plastic crack growth in singly grooved tensile specimens is characterized locally by the directions and amounts of fracture and slip on various planes. The model relates macroscopic quantities, including the crack growth ductility, defined as the axial displacement per unit ligament reduction, which is of practical importance in determining the stiffness of the surrounding structure that is needed to prevent unstable fracture. Applied to six different structural alloys with strain hardening exponents from 0.1 to 0.2, the model gave crack growth ductilities within 10% for the symmetrical configurations, where the value ranged from 0.25 to 0.4, were unrelated to the strain hardening exponent. For the asymmetrical configurations that occur near welds or shoulders, the crack growth ductility for the low hardening materials drops to 0.07 to 0.11. The predicted values were uniformly high by a factor of two, providing a good relative ranking of the alloys. Other macroscopic correlations were generally within 10%. Thus this slip plane model of fully plastic crack growth provides a useful correlation between macroscopic measurements made on the specimens after fracture, and the important loss of crack growth ductility that occurs in asymmetric configurations with materials with low strain hardening. GRA

N87-14739# Lehigh Univ., Bethlehem, Pa.
FATIGUE AND FRACTURE MECHANICS OF STRUCTURAL METALS, PLASTICS, AND COMPOSITES Final Report, 31 Jan. 1985 - 24 Jan. 1986
Richard W. Hertzberg 18 Aug. 1986 8 p
(Grant AF-AFOSR-0138-85)
(AD-A173064; AFOSR-86-0919TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

AFOSR/DOD-URIP funds were used to purchase an Instron computer-controlled mechanical test system for the purpose of evaluating the fatigue and fracture response of metals, plastics, and composites. The FCP Run program provided with the test system has been modified to include differing testing options (constant K sub max and constant K sub mean decreasing K threhold procedure) and incorporate stress intensity factor and compliance calibrations for several additional specimen configurations. Experiments have been conducted with both plastics and metals to confirm the usefulness of the system and the modifications of the software. GRA

N87-14740# Oak Ridge National Lab., Tenn.
IN-SITU TEM STUDIES OF CRACK TIP DEFORMATION IN MOLYBDENUM
C. G. Park and S. M. Ohr (State Univ. of New York, Stony Brook.) 1986 6 p Presented at the NATO Workshop on Chemistry and Physics of Fracture, Bad Reichenhall, West Germany, 22 Jun. 1986 Prepared in cooperation with State Univ. of New York, Stony Brook.
(Contract DE-AC05-84OR-21400)
(DE86-013346; CONF-8606168-1) Avail: NTIS HC A02/MF A01

Although the mode of crack propagation has been shown to be closely related to the behavior of crack tip dislocations and the loading conditions, the details of their relationship are not well understood. This paper describes the effects of the loading condition on the distribution of dislocations, the dislocation-free zone, and the crack tip slip systems observed during in situ TEM deformation of molybdenum. Purpose of this study was to find parameters that are responsible for determining the geometry of crack tip deformation. DOE

N87-14741# International Centre for Theoretical Physics, Trieste (Italy).
APPLICATION OF INFRARED TECHNIQUE IN RESEARCH OF MECHANICAL PROPERTIES
Y. Huang and C. H. Shih Aug. 1985 10 p Prepared in cooperation with Academia Sinica, Shenyang (China)
(DE86-702769; IC-85/180) Avail: NTIS (US Sales Only) HC A02/MF A01

The infrared technique as a new method is more useful for research of materials science. This paper simply describes the techniques of infrared temperature measurement and thermography and provides the experimental data of some metals and alloys during the deformation and the fatigue process by use of

the infrared sensing method. It is shown that the conventional tensile data can be correlated with infrared radiational energy change during the tensile pulling. The temperature field of metal during elastic-plastic deformation can be calculated by finite element analysis, and the thermoelastic effect of metal can be shown by thermography. The infrared technique can be used to predict the fatigue damage, monitor their propagations and give the alarm at fracture. Finally, it must be pointed out that the irreversibility of infrared emission of metal can be used as a basis of nondestructive testing. DOE

N87-14742# Sandia National Labs., Albuquerque, N. Mex.
FREQUENCY RESPONSE FUNCTIONS OF A NONLINEAR SYSTEM
D. A. Dederman, T. L. Paez, D. L. Gregory, and R. G. Coleman 1986 12 p Presented at the 57th Shock and Vibration Symposium, New Orleans, La., 14 Oct. 1986
(Contract DE-AC04-76DP-00789)
(DE86-016103; SAND-86-1175C; CONF-8610140-1) Avail: NTIS HC A02/MF A01

The presence of nonlinear elements in a structural system can have a substantial effect on measures of structural response which characterize linear behavior. A form of nonlinearity frequently observed in complicated structures is the rattling nonlinearity that results from impact of structural elements. The objective of this investigation is to establish the effects on the frequency response function of a simple system caused by structural rattling. The study uses a Monte Carlo approach in conjunction with numerical response analysis and laboratory experiments to assess the characteristics of the system. It is shown that the presence of rattling components in a structural system tends to diminish amplification of motion at structural modal frequencies and introduce additional frequency response throughout the remainder of the excitation bandwidth. DOE

N87-14743# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.
TRANSIENT RESPONSE OF IMMERSED STRUCTURES Final Report [REPONSES TRANSITOIRES DE STRUCTURES IMMERGEES]
R. Ohayon Jan. 1986 48 p In FRENCH
(Contract DRET-84-34-oct)
(ONERA-RT-29/3043-RY-044-R; ETN-86-98424) Avail: NTIS HC A03/MF A01

Elastodynamic variational analysis is applied to describe the transient response of coupled fluid-structure linear systems. The method employs the Kirchoff operator and finds by extreme asymptotic approximations a first integral of the external fluid. The approximation is of the incompressible fluid type in the case of long times or acoustic geometry in the case of short times. ESA

N87-14744# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
MODELING OF FATIGUE CRACK GROWTH IN 7075-T651 ALUMINUM ALLOY PLATE
R. J. H. Wanhill, A. U. deKoning, and L. Schra 15 Nov. 1985 15 p Presented at 6th European Conference on Fracture (ECF6), Amsterdam, Netherlands, 15-20 Jun. 1986
(NLR-MP-85082-U; B8669294; ETN-86-98690) Avail: NTIS HC A02/MF A01

A test program was done with a simplified landing gear spectrum to check assumptions in the crack growth model CORPUS. Crack opening stress intensity factors estimated by CORPUS were compared with clip gage and fractographic estimates. Crack growth predictions were compared with experimental results. Predictions were made using CORPUS and a characteristic-K approach. Results validate the CORPUS approach and the K approach. ESA

N87-14745# Southampton Univ. (England). Inst. of Sound and Vibration Research.
[ACTIVITIES REPORT OF THE INSTITUTE OF SOUND AND VIBRATION RESEARCH] Annual Report, year ending Mar. 1986
1986 46 p
(ETN-86-98365) Avail: NTIS HC A03/MF A01

Research in fluid dynamics and acoustics; noise and vibration control; audiology and human effects; structures and machinery; automotive design; signal processing; and shock analysis is summarized. ESA

N87-14746# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
ULTRASONIC FATIGUE STUDIES OF SHORT AND LONG SURFACE CRACKS
A. F. Blom, A. I. Gustavsson, A. Hadrboletz, and B. Weiss Aug. 1986 24 p Presented at the Institution of Mechanical Engineers International Conference on Fatigue of Engineering Materials and Structures, Sheffield, England, 15-19 Sep. 1986
(FFA-TN-1986-44; ETN-86-98558) Avail: NTIS HC A02/MF A01

The extension of a high frequency resonance technique to three dimensional fatigue crack growth is described. Determination of stress intensity factor solutions for semielliptical crack shapes in resonance type specimens is performed by compliance measurements and finite element modeling. Experimental studies were performed on Al 7475-T761 to study the growth behavior of short and long surface cracks. In order to verify the experimental technique, fatigue threshold tests were performed and compared to low frequency test data and to two-dimensional test results. ESA

N87-14747# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
LOAD INTERACTION EFFECTS ON FATIGUE CRACK PROPAGATION IN STEELS OF VARYING STRENGTH
Anders F. Blom and Dan K. Holm (Royal Inst. of Tech., Stockholm (Sweden).) Aug. 1986 21 p Presented at the International Conference on Role of Fracture Mechanics in Modern Technology, Fukuoka, Japan, 2-6 Jun. 1986 Sponsored by the Swedish Board for Technical Development Prepared in cooperation with Swedish Steel AB
(FFA-TN-1986-47; ETN-86-98559) Avail: NTIS HC A02/MF A01

An analytical-numerical model of crack growth retardation in metals subjected to spectrum loading is presented. The model is applied to simulate overload experiments on steels of various strengths. The numerically obtained results are shown to correlate to experimental results quite well. By studying the results it is possible to explain seemingly contradictory results from different sets of experiments. It is shown that higher strength steels may be superior or inferior to lower strength steels in spectrum fatigue, depending on the load sequence used. These results are interpreted in terms of plasticity-induced crack closure. The influence of strain hardening on crack closure levels was assessed. ESA

N87-14748# Technische Hogeschool, Delft (Netherlands). Tussenafdeling der Metaalkunde.
NUMERICAL CALCULATIONS OF EXTRUSION BY CONICAL MOLDS Thesis [NUMERIEKE BEREKENINGEN AAN EXTRUSIE DOOR CONISCHE MATRIJZEN]
C. C. Tak 1985 65 p In DUTCH
(ETN-87-98700) Avail: NTIS HC A04/MF A01

The influence of mold parameters on the extrusion pressure and stress distribution during extrusion by conical molds was investigated. The consequences of the conditions of axial symmetry, and the redundant work during deformation are discussed. The finite element program DIEKA used for the calculations is presented. This program is suited to simulation of very large elastic-plastic deformations. The finite element formulation and the realization of a combined Euler-Lagrange description are explained. The results give a qualitatively correct picture, but the extrusion pressures are systematically too high. The effect of the mesh size on the extrusion pressure must be studied in detail. ESA

N87-14749# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).

EXPERIMENTAL INVESTIGATIONS OF DYNAMIC EFFECTS IN IMPACT TESTS Ph.D. Thesis - Technische Hochschule, Darmstadt, West Germany [EXPERIMENTELLE UNTERSUCHUNGEN DYNAMISCHER EFFEKTE BEIM KERBSCHLAGBIEGEVERSUCH]

W. Boehme Jun. 1985 138 p In GERMAN Sponsored by Deutschen Forschungsgemeinschaft, and Stiftung Volkswagenwerk

(W-1/85; D-17; ETN-87-98734) Avail: NTIS HC A07/MF A01

The dynamic behavior of three-point bend specimens under impact loading was experimentally investigated. Several measuring methods, especially the shadow-optics caustics technique, were used. Qualitative differences between the static and dynamic loading behavior are demonstrated. A qualitative description of the loading behavior was given with a quasistatic analysis using a simple spring-mass model. Starting from this basis, the dynamic effects in model experiments were quantitatively determined with dynamic correction functions, and discussed with respect to wave phenomena. The influence of the system parameters on the dynamic loading behavior is reviewed. Examples show that the results of the model investigations can be transfered to other test conditions. Loading behavior predictions are possible only on the basis of the system parameters, resulting in a simple possibility to determine the fracture toughness characteristics at high loading rates. ESA

N87-14750# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).

[ACTIVITIES REPORT IN MATERIALS MECHANICS] Progress Report, 1985 [TAETIGKEITSBERICHT 1985]

1985 110 p In GERMAN

(ISSN-0713-9956; ETN-87-98736) Avail: NTIS HC A06/MF A01

Research on the characterization, evaluation, and optimization of mechanical and materials-specific component properties under different loading conditions is presented. Strength analysis of metallic and nonmetallic materials, experimental and theoretical-numerical stress analysis, and surface strength are discussed. ESA

N87-14751# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

INITIATION AND PROPAGATION OF CRACKS IN NOTCHED UNIDIRECTIONAL LAMINATES OF CARBON FIBER REINFORCED EPOXY UNDER STATIC TENSILE LOAD

Hans Eggers, Ludwig Kirschke, and Rolf Zick Jun. 1986 214 p (DFVLR-FB-86-30; ISSN-0171-1342; ETN-87-98859) Avail: NTIS HC A10/MF A01; DFVLR, Cologne, West Germany DM 72.50

For tension loading, matrix splitting was tested on notched rectangular specimens of unidirectional carbon fiber-reinforced epoxy T300-914C. Crack propagation, notch opening displacements, and specimen elongation were measured in dependence on tensile force. Crack behavior was analyzed by acoustic emission measurements, X-ray, ultrasonic and REM-photographs. Analytical methods, based on linear fracture mechanics, were used to evaluate the stress intensity factors, the energy release rate, and its splitting for mode 1 and 2. The established interaction diagrams describe the crack initiation at the notch tip of unidirectional laminates. ESA

N87-14752# GKSS-Forschungszentrum Geesthacht (West Germany).

DETERMINATION OF THE CRACK TIP OPENING DISPLACEMENT (CTOD) AND CRACK BLUNTING (OR STRETCH ZONE WIDTH, SZW) USING THE J INTEGRAL [BESTIMMUNG DER RISSSPITZENAUFWEITUNG CTOD UND RISSABSTUMPFUNG SZW AUS DEM J-INTEGRAL]

A. Cornec, J. Heerens, and K.-H. Schwalbe 1986 18 p In GERMAN

(GKSS-86/E/15; ISSN-0344-9629; ETN-87-98875) Avail: NTIS HC A02/MF A01

An approximation method to determine the correlation between J integral, CTOD and SZW with high reliability and accuracy and with general validity is presented. Examples show that the method is valid for arbitrary materials laws and for arbitrary three-dimensional crack front. The deformations at the crack front follow the continuum mechanics laws which predict a continuous rounding of crack tip. The experimental SZW measurements show a relatively high uncertainty (25%) as compared to the theoretical blunting line. The proposed blunting line is essential for the improvement of the present standards. ESA

N87-14753# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).

NUMERICAL SIMULATIONS OF IMPACT TESTS ON ELASTOPLASTIC MATERIALS [NUMERISCHE SIMULATIONEN DES KERBSCHLAGVERSUCHS AN ELASTOPLASTISCHEN WERKSTOFFEN]

H. Stoeckl and W. Schmitt May 1986 54 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(Rept-W-5/86; ETN-87-98877) Avail: NTIS HC A04/MF A01

Impact tests on Charpy specimens were simulated numerically. Two and three-dimensional models were used. Displacement of the specimen as a function of time, and crack extension as a function of displacement were prescribed according to data obtained quasistatically. Force was calculated as a function of displacement and was compared with the measured data. From the numerical simulation and from the experimental force-displacement-curve, J-resistance curves were determined for average J-values. From three-dimensional calculations, the function of J along the crack front was calculated. The dynamic behavior of the specimen could be described qualitatively, but not quantitatively. Dynamic modeling yields force-displacement-curves which differ from quasistatic ones by superimposed oscillations. In J-resistance curves these oscillations are smaller. ESA

N87-14754 United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.

EFFECT OF NON-ALIGNMENT OF SPECIMEN AND TEXTURE AXES ON THE MEASUREMENT OF STRESS USING THE ULTRASONIC SH WAVE TECHNIQUE

C. M. Sayers and G. P. Clarke Mar. 1986 14 p

(AERE-R-12071) Copyright. Avail: Issuing Activity

In an unstressed orthorhombic material the shear wave velocity is invariant under an interchange of the propagation and polarization directions, if these directions lie along the principal texture axes of the material. In the presence of a stress with principal stress directions coincident with the principal texture axes, this symmetry is broken and the change in the velocity when the propagation and polarisation directions are interchanged is given by the difference in stresses along the propagation and polarisation directions. In this paper, the effect of a misalignment of the symmetry and sample planes on this relationship has been examined. For austenitic welds, an error in the determination of stress of the order of yield can occur for tilts of 5 deg. However, for structural steels with textures very much less than the theoretical maximum, a determination of the stress present to an accuracy of 10% of yield remains possible using this technique. Author

N87-14755# United Kingdom Atomic Energy Authority, Harwell (England). National NDT Centre.

THE APPLICATION OF ULTRASONIC ATTENUATION SPECTRAL ANALYSIS TO MATERIALS CHARACTERISATION

R. L. Smith Sep. 1985 26 p

(AERE-R-11885) Avail: NTIS HC A03/MF A01

The technique of ultrasonic attenuation spectral analysis has been developed for materials characterization and successfully applied to a number of materials. The basic results of this work have been reported in a number of enclassified reports and the technique applied to certain specific problems under commercial contracts. The results of a number of feasibility studies carried out on various materials to solve specific problems are discussed here. The potential and limitations of the technique are clearly illustrated. Author

N87-14756# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
DIFFRACTION OF ELASTIC WAVES BY DEFECTS IN PLATES: CALCULATED ARRIVAL STRENGTHS FOR POINT FORCE AND THERMOELASTIC SOURCES OF ULTRASOUND
C. B. Scruby, K. R. Jones, and L. Antoniazzi Jan. 1986 41 p
(AERE-R-11456) Avail: NTIS HC A03/MF A01

Calculations were made of the amplitudes of diffraction waves from defects in specimens such as plates, in order to predict what data might be expected when using laser techniques to detect the defects. Considerable use is made ot the calculations of Ogilvy and Temple (1983) and Chapman (1981) for the diffraction coefficients. Attention is focused on the first main bulk wave arrivals at the surface, and the calculations are restricted to typical experimental arrangements for Time-of Flight measurements, with the source and receiver on the same surface of the plate. Comparison was made between the amplitudes predicted for the thermoelastic (e.g., laser) source and the normal force source (e.g., piezoelectric transducer). Finally, some simulated Time-of-Flight B-scan data are presented, which can be compared with typical experimental data. B.G.

N87-14757# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
ANGULAR DEPENDENCE OF THE ULTRASONIC SH WAVE VELOCITY IN ROLLED METAL SHEETS
C. M. Sayers and G. G. Proudfoot Jan. 1986 30 p
(AERE-R-12077) Avail: NTIS HC A03/MF A01

The ultrasonic SH wave technique is a promising method for separating out the effects of texture and stress on the ultrasonic velocity, and allows the texture and stress to be determined separately. Allen and Langman have reported measurements of the angular dependence of the SH wave velocity in several unstressed rolled metal sheets of aluminium, stainless steel, copper and brass. Here neutron diffraction measurements of the texture of several of these sheets are presented, and parameters entering into an expansion of the crystallite orientation distribution function are determined. These are in good agreement with the values obtained by fitting the ultrasonic results to theory. The validity of the first order expression for the effect of texture is assessed, and the contribution due to beam skewing is calculated. Author

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N87-14758 Deutsche Geodaetische Kommission, Munich (West Germany).
GERMAN-AUSTRIAN STELLAR TRIANGULATION PROJECT USING BALLOON SONDES [DEUTSCH-OESTERREICHISCHES STELLARTRIANGULATIONSPROJEKT MIT BALLONSONDEN]
1985 89 p In GERMAN; ENGLISH summary
(Ser-B-278; ISBN-3-7696-8564-4; ISSN-0065-5317;
ETN-86-98237) Copyright. Avail: Issuing Activity

The development and the purposes of the German-Austrian stellar triangulation project are outlined. The experimental part of the project using balloon-borne flashlight sondes is presented. The evaluation of the observations and the analysis of the results are described. For individual titles, see N87-14759 through N87-14761.

N87-14759 Deutsche Geodaetische Kommission, Munich (West Germany).
GERMAN-AUSTRIAN STELLAR TRIANGULATION PROJECT USING BALLOON SONDES. DEVELOPMENT AND PURPOSE OF THE PROJECT [DEUTSCH-OESTERREICHISCHES STELLARTRIANGULATIONSPROJEKT MIT BALLONSONDEN. ENTWICKLUNG UND ZIELSETZUNG DES PROJEKTS]
K. Rinner and R. Sigl *In its* German-Austrian Stellar Triangulation Project Using Balloon Sondes 1985 p 5-8 In GERMAN (For primary document see N87-14758 06-43)
Avail: Issuing Activity

The German-Austrian stellar triangulation project aims to develop a method for stellar triangulation using balloon sondes to support first order ground triangulation in Saudi Arabia. The historical evolution of the project is depicted. The developed sondes prove to be reliable and well observable; the observation technique proves to be satisfactory. ESA

N87-14760 Deutsche Geodaetische Kommission, Munich (West Germany).
GERMAN-AUSTRIAN STELLAR TRIANGULATION PROJECT USING BALLOON SONDES. ENGINEERING AND OBSERVATIONS [DEUTSCH-OESTERREICHISCHES STELLARTRIANGULATIONSEXPERIMENT MIT BALLONSONDEN. VERFAHRENSTECHNIK UND BEOBACHTUNGEN]
R. J. Cuno, E. Wolf, and G. Chesi *In its* German-Austrian Stellar Triangulation Project Using Balloon Sondes 1985 p 9-47 In GERMAN; ENGLISH summary (For primary document see N87-14758 06-43)
Avail: Issuing Activity

The experimental part of the German-Austrian stellar triangulation project, carried out during the years 1978 through 1980 in the Lower Alps using balloon-borne flashlight sondes, is presented. The geometrical and meteorological conditions to be considered in the planning of observations are discussed. The flashlight sondes and the observation equipment, as well as the mobile balloon launching station and the four observation stations are described. The practical course of balloon launchings and of observations is explained. The necessary logistic and organizational preparations are listed. The observations are summarized. ESA

N87-14761 Deutsche Geodaetische Kommission, Munich (West Germany).
GERMAN-AUSTRIAN STELLAR TRIANGULATION PROJECT USING BALLOON SONDES. EVALUATION OF OBSERVATIONS AND ANALYSIS OF THE RESULTS [DEUTSCH-OESTERREICHISCHES NT MIT BALLONSONDEN. AUSWERTUNG DER BEOBACHTUNGEN UND ANALYSE DER ERGEBNISSE]
GEN UND ANALYSE DER ERGEBNISSE]
G. Chesi, K. Kaniuth, and R. Zernecke *In its* German-Austrian Stellar Triangulation Project Using Balloon Sondes 1985 p 49-88 In GERMAN; ENGLISH summary (For primary document see N87-14758 06-43)
Avail: Issuing Activity

Observations to derive the spatial directions of three baselines with a length between 160 and 180 km are described. The calculation of the topocentric directions for the balloon sondes, and of the spatial directions between the observation stations are outlined. Accuracies are of the order of 0.5 and 1.5 arcsec and do not meet expectations. The main error source is considered to be the modeling of the refraction at high zenith distances, up to 80 deg arc. The results are compared with those derived from the adjustment of the European Triangulation Network. ESA

N87-14762 Deutsche Geodaetische Kommission, Munich (West Germany).
AN EXTENDED MATHEMATICAL MODEL OF AEROTRIANGULATION FOR HIGHLY PRECISE POINT DETERMINATION Ph.D. Thesis - Stuttgart Univ., West Germany [EIN ERWEITERTES

MATHEMATISCHES MODELL DER AEROTRIANGULATION ZUR HOCHGENAUEN PUNKTBESTIMMUNG]
Ralf Schroth 1986 149 p In GERMAN
(Ser-C-316; ISBN-3-7696-9366-3; ISSN-0065-5325; ETN-86-98234) Copyright. Avail: Issuing Activity

A stochastic model for photogrammetric bundle block adjustment was derived. The mathematical model is based on the knowledge of the formal relations between different model suppositions in the adjustment calculation and the statistics. The combined model containing an extended functional part and a completely structured stochastic part is the basis for the extended mathematical model. The most important innovations compared to conventional models are the treatment of additional self calibration parameters as stochastic quantities, and the description of the correlation of pictures using autoregressive processes. The efficiency of the model with respect to conventional models is demonstrated by experiments and computer simulations. ESA

N87-14763 Deutsche Geodaetische Kommission, Munich (West Germany).
CONSTRUCTION OF A DIGITAL HEIGHT MODEL BASED ON SIMPLE FINITE ELEMENTS Ph.D. Thesis - Technische Univ., Munich, West Germany [AUFBAU DIGITALER HOEHENMODELLE AUF DER GRUNDLAGE EINFACHER FINITER ELEMENTE]
Peter Reiss 1985 165 p In GERMAN
(Ser-C-315; ISBN-3-7696-9365-5; ISSN-0065-5325; ETN-86-98235) Copyright. Avail: Issuing Activity

A method for the construction of a digital height model (DHM), called height interpolation with finite elements, and based on a square grid is presented. The mathematical fundamentals (spline functions, B-splines), the profile approximation of irregularly distributed support values by equidistant nodes, and the plane approximation of irregularly distributed support values by a quadratic grid, are presented. The integration of the method in the finite element method, the relation to similar approximation methods and to interpolation with weight functions, and integration in Schut's classification are outlined. The test domain, data acquisition, and computer programs are presented. The behavior of the bilinear approximation supposition in the case of variation of several project parameters, the effect of the data acquisition and the point density in the case of bilinear supposition, the dependence of the height accuracy on the position in the grid for the bilinear and the bicubic supposition, and the estimation of the weights are discussed. ESA

N87-14764# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE BURNED AREA AND REGENERATION OF VEGETATION AFFECTED BY THE FIRE IN THE PARQUE NACIONAL DE BRASILIA THROUGH TM/LANDSAT DATA [AVALIACAO DA AREA QUEIMADA E DA REGENERACAO DA VEGETACAO AFETADA PELO FOGO NO PARQUE NACIONAL DE BRASILIA ATRAVES DE DADOS DO TM/LANDSAT]
Flavio Jorge Ponzoni, David Chung Liang Lee, and Pedro Hernandez Filho Nov. 1986 24 p In PORTUGUESE; ENGLISH summary
(INPE-4035-RPE/522) Avail: NTIS HC A02/MF A01

A study utilizing TM/LANDSAT multitemporal images in the monitoring, burned area evaluation and the vegetation regeneration following a fire is done in the Parque Nacional de Brasilia (PNB). Author

N87-14765# SACLANT ASW Research Center, La Spezia (Italy).
A DIRECTORY OF GROUND CONTROL POINTS FOR MAPPING SATELLITE IMAGES OVER THE NORTHEASTERN ATLANTIC OCEAN AND ADJACENT SEAS
Brian Wannamaker, Elvio Nacini, and Peter Minnet Feb. 1986 131 p
(AD-A170290; SACLANTCEN-SR-93) Avail: NTIS HC A07/MF A01 CSCL 08/2

The precise geographical location and height of a set of 638 'ground control points' are listed for use in remapping satellite imagery to standard map projections. The area covered includes the NE Atlantic Ocean and the Mediterranean, Baltic, North, Greenland, Iceland and Norwegian Seas. Author (GRA)

N87-14766# Analytic Sciences Corp., Reading, Mass.
AIDED-AIRBORNE GRAVITY GRADIOMETER SURVEY SYSTEM (GGSS) STUDY Final Report, Sep. 1983 - Sep. 1985
Steven J. Brzezowski and Robert C. Merenyi Mar. 1986 132 p
(Contract F19628-83-C-0146)
(AD-A170749; TASC-TR-4769-2; AFGL-TR-86-0059) Avail: NTIS HC A07/MF A01 CSCL 17/7

Several mechanization variants of the GGSS baseline configuration have been analyzed to assure an optimal and robust design and to establish confidence in the various navigation back-up modes. The analysis determined the current and anticipated performance of several sensors, individually and then in appropriate combination with the GGSS. Until more of the full Global Positioning System (GPS) constellation is in place, the currently planned precise reference clock and altimeter aides are capable of providing the increased visibility intervals and navigation accuracies required for GGSS airborne testing and initial survey operations. Moving-receiver radio interferometry to GPS is the most promising approach for satisfying the stringent navigation accuracies which may be required for GGSS surface testing. Furthermore, an improved measurement of gravity can be attained by augmenting a GGSS aiding gravimeter with interferometrically derived position and velocity. GRA

N87-14767# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
INTEGRATION OF ARTIFICIAL INTELLIGENCE CONCEPTS INTO THE METHODS FOR EXTRACTING LINE OBJECTS FROM MONOCHROMATIC AERIAL IMAGERY Final Technical Report
R. Neu, W. Heissler, H. Kazmierczak, and M. Sties Mar. 1986 83 p
(Contracts DAJA45-84-C-0014; DA Proj. 1T1-61102-BH-57)
(AD-A170884; ETL-0425) Avail: NTIS HC A05/MF A01 CSCL 14/5

Procedures for automatic extraction of line shaped objects from aerial images have been improved and completed. A general model of road network has been used to complete road extraction from images. Digital elevation data has been used to guide the process of river and creek extraction from images. The methods have been implemented on a DEC VAX 11/780. The functions are described in detail. Test results and assessment are included in the report. Author (GRA)

N87-14768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MODIFICATION OF PARAMETERIZED LATENT HEAT RELEASE ESTIMATES USING UNENHANCED AND ENHANCED SATELLITE IMAGERY M.S. Thesis
William F. Sjoberg May 1986 118 p
(AD-A170899; AFIT/CI/NR-86-67T) Avail: NTIS HC A06/MF A01 CSCL 04/2

The objectives of this research are to compare the parameterized latent heat release estimates obtained from the SESAME I data set with observed precipitation values and radar fields; to test three procedures for utilizing satellite cloud images to modify these conventional latent heating estimates; and to propose a procedure which combines latent heat release calculations and satellite imagery whose results exhibit the best comparison with observational data forms. GRA

N87-14769# Mullard Space Science Lab., Dorking (England).
ANALYSIS OF ALTIMETRY DATA FROM THE MARGINAL ICE ZONE EXPERIMENT, EXECUTIVE SUMMARY
N. F. McIntyre, H. D. Griffiths, A. R. Birks, A. M. Cowan (Cambridge Univ. (England).), M. R. Drinkwater, E. Novotny, R. J. Powell, V. A. Squire, L. M. H. Ulander, and C. L. Wrench Paris, France ESA Jan. 1986 18 p Prepared in cooperation with University Coll., London, England, Science Research Council, Chilton, England, and Cambridge Univ., England
(Contract ESTEC-5948/84-NL-BI)
(ESA-CR(P)-2215; ETN-86-98097) Avail: NTIS HC A02/MF A01

Data collected by an airborne radar altimeter in the Greenland and Norwegian Seas and in northern Norway, Svalbard, and Greenland were analyzed. The detection of radar retroreflectors from an airborne platform are demonstrated, and accuracies and optimal experimental set-up are assessed. The feasibility of locating the position of ERS-1 with this technique is discussed. Data overflights of a range of ice sheet and sea ice surfaces are analyzed and, in the light of complementary data sources, the extraction of information other than that conventionally derived from altimetry is investigated. Simulations indicate which of these products can be extracted from satellite data. The accuracy of altimetric measurements over the ocean, and the extent to which such data may be relied upon for the verification of satellite investigations are considered. ESA

N87-14770# European Space Agency, Paris (France). ESA Land Applications Working Group.
REMOTE SENSING FOR ADVANCED LAND APPLICATIONS
Bruce Battrick, ed. and Erica Rolfe, ed. Jul. 1986 123 p Original contains color illustrations
(ESA-SP-1075; ETN-86-98538) Avail: NTIS HC A06/MF A01

Mission objectives and measurement requirements for a land applications remote sensing satellite to provide an integrated set of optical and microwave data were investigated. Thematic land applications related to renewable and nonrenewable Earth resources, and environmental aspects, such as land transformation processes, that affect interactions between the Earth surface and atmosphere were considered. A multispectral optical and SAR payload on a polar platform is recommended. A high-resolution imaging spectrometer, a microwave radiometer with more than one channel, as well as a gas-correlation spectrometer, and meteorological instruments of the type necessary for atmospheric corrections and environmental studies must be added. ESA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N87-14771*# Sverdrup Technology, Inc., Cleveland, Ohio.
CONCEPTUAL DEFINITION OF A TECHNOLOGY DEVELOPMENT MISSION FOR ADVANCED SOLAR DYNAMIC POWER SYSTEMS Final Report
Robert P. Migra Jul. 1986 128 p
(Contract NAS3-24105)
(NASA-CR-179482; E-3132; NAS 1.26:179482) Avail: NTIS HC A07/MF A01 CSCL 10B

An initial conceptual definition of a technology development mission for advanced solar dynamic power systems is provided, utilizing a space station to provide a dedicated test facility. The advanced power systems considered included Brayton, Stirling, and liquid metal Rankine systems operating in the temperature range of 1040 to 1400 K. The critical technologies for advanced systems were identified by reviewing the current state of the art of solar dynamic power systems. The experimental requirements were determined by planning a system test of a 20 kWe solar dynamic power system on the space station test facility. These requirements were documented via the Mission Requirements Working Group (MRWG) and Technology Development Advocacy Group (TDAG) forms. Various concepts or considerations of advanced concepts are discussed. A preliminary evolutionary plan for this technology development mission was prepared. Author

N87-14772# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Renewable Programs.
FIVE YEAR RESEARCH AND DEVELOPMENT PLAN, 1986-1990. NATIONAL SOLAR THERMAL TECHNOLOGY PROGRAM
Sep. 1986 36 p
(DE86-013644; DOE/CE-0160) Avail: NTIS HC A03/MF A01

This Solar Thermal Technology Program Five Year Research and Development Plan discusses the planning process and describes in more detail the first five years of the long term strategy for the development of solar thermal technology. The overall strategy is to focus and structure the activities which should lead to broad economic competitiveness for solar thermal. The state of each of the technologies is first assessed to determine the characteristics of the next system which could be built. These are referred to as current capabilities. Cost/performance goals are then determined which would allow solar thermal technology to compete in the free marketplace for electricity and heat production and appear to be technically achievable in the 1990's. The critical advanced components and development decisions are identified and finally, tasks addressing each of these are delineated. DOE

N87-14773# Pacific Northwest Labs., Richland, Wash:
UPDATED WIND ENERGY RESOURCE ASSESSMENT OF THE US
D. L. Elliott Aug. 1986 11 p Presented at the 16th American Wind Energy Association National Conference and 5th Wind Energy Expo 86, Cambridge, Mass., 1 Sep. 1986
(Contract DE-AC06-76RL-01830)
(DE86-015788; PNL-SA-14145; CONF-860942-1) Avail: NTIS HC A02/MF A01

An updated assessment of the wind energy resource throughout the United States and its territories was recently completed by the Pacific Northwest Laboratory. The results of this assessment are described in a comprehensive document, Wind Energy Resource Atlas of the United States (Elliott et al., 1986), published by the Solar Energy Research Institute. The atlas includes over 100 maps (30 in color) and lists wind resource statistics for over 1000 locations. The distribution of the wind energy resource is depicted both on a national scale and in greater detail for each state or territory. This atlas should be especially useful to wind energy developers and potential wind energy users because it provides the most up-to-date assessment of the national wind energy resource available. The updated assessment synthesizes the results of twelve regional assessments completed in 1980 and incorporates information from hundreds of new measurement sites installed in the late 1970s and early 1980s. Most of the data used in the earlier assessments were from conventional locations, such as airports and military bases; most of the new site data were from well-exposed locations more representative of potential wind turbine sites. After these new site data were analyzed, the annual and seasonal average wind energy resource estimates, the uncertainty ratings (degree of confidence credited to the resource estimates), and areal distributions (percent land area having a specified wind resource) were revised over many areas of the United States. This paper describes the results of the updated wind energy assessment and highlights some of the major wind resource areas in the contiguous United States. DOE

N87-14774# Sandia National Labs., Albuquerque, N. Mex.
DEVELOPMENTS IN BLADE SHAPE DESIGN FOR A DARRIEUS VERTICAL AXIS WIND TURBINE
T. D. Ashwill and T. M. Leonard Sep. 1986 20 p
(Contract DE-AC04-76DP-00789)
(DE86-016056; SAND-86-1085) Avail: NTIS HC A02/MF A01

A new computer program package has been developed that determines the troposkein shape for a Darrieus Vertical Axis Wind Turbine Blade with any geometrical configuration or rotation rate. This package allows users to interact and develop a buildable blade whose shape closely approximates the troposkein. Use of this package can significantly reduce flatwise mean bending stresses in the blade and increase fatigue life. DOE

N87-14775# Kernforschungsanlage, Juelich (West Germany). Programmgruppe Systemforschung und Technologische.
APPLIED SYSTEM ANALYSIS NO. 45: SOLARYS, AN INTERACTIVE MODEL FOR THE SIMULATION OF SOLAR SYSTEMS,

PARTS 1 AND 2 [ANGEWANDTE SYSTEMANALYSE NR. 45. SOLARYS, EIN INTERAKTIVES MODELL ZUR SIMULATION VON SOLARSYSTEM, TEIL 1 UND TEIL 2]
Peter W. Wensiersaki Feb. 1986 248 p In GERMAN
(JUEL-Spez-346-Pt-1-Pt-2; ISSN-0343-7639;
ETN-86-98205-Pt-1-Pt-2) Avail: NTIS HC A11/MF A01

The interactive simulation model SOLARYS was developed to cover a broad spectrum of input in the computerized simulation of solar energy systems and to enable a flexible realization of system variants. The mathematical treatment of dynamic and stationary equation systems is presented. Special structural elements free the user from cumbersome input and output routines, and enable the organization and comprehensive integration of functional and differential equations of independent modules. The test phase of a developed system program as well as the arrangement of simulation in tables and graphs are supported by a dialog program in a user friendly way. The physical equation of the module, as well as the input and output quantities are documented. The global programming and simulation process is divided into a preparation step and the real simulation phase. ESA

N87-14776# Konstanz Univ. (West Germany). Fakultaet fuer Physik.
DEVELOPMENT OF NEW SOLAR CELLS FROM POLYSILICON, SILICON POWDER AND NEW COMPOUND SEMICONDUCTORS SUITABLE FOR THIN FILM CELLS Final Report, Jun. 1984
Ernst Bucher, Peter Munz, Martha Christine Lux-Steiner, and Ingrid Frankowski Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 38 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-003; ISSN-0340-7608; ETN-86-98286) Avail: NTIS HC A03/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 8

With p/Si/Sc MIS cells with 4 sqcm area, Voc (AMO) = 632 mV and an efficiency n of 12.5 % was achieved; Voc and Jsc were studied as function Boron-doping for semiconductor cells and p-Silco. From S-Web and sintered Si powder Sc MIS cells were made with efficiencies of 6.6% and 2.7% respectively, whereas with Heliosil material n = 9.5%. Cells with sputtered Sc were also investigated: n = 8% is found. Schottky diodes made from n-Si/IrSi1.75 were explored, but low Voc's of 350 to 400 mV found. Si-wafers made from Si-powder were produced and studied by capacitor discharge and vacuum arc plasma spray techniques. Diodes from compound semiconductors: p-Zn3P2/Sc, p/n WSe2, p-WSe2/n-MoSe2, p-WSe2/n-ZrSe3, p-WSe2/n-CdS were studied, the latter with best efficiencies of 6.2% and maximum Voc of 630mV; sintered p-WSe2/CdS was also made with n = 0.8%. ESA

N87-14777# Maschinenfabrik Augsburg-Nuernberg A.G., Munich (West Germany).
GERMAN-KOREAN COOPERATION FOR ERECTION AND TEST OF INDUSTRIALIZED SOLAR TECHNOLOGIES Final Report, Jun. 1984
Heinz Pfeiffer Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 108 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-006; ISSN-0340-7608; ETN-86-98287) Avail: NTIS HC A06/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 22.50

A combined small solar-wind power station and a solar-thermal experimental plant were built. The plants are designed to demonstrate the effective exploitation of solar energy and wind energy and enhanced availability achievable through combination of these two energy sources. A 14 kW wind energy converter and a 2.5 kW solar-cell generator were operated in parallel. The biaxial tracking system used on the solar generator leads to increased and constant generation of electricity throughout the day. A consumer control system switches the energy generators and the consumers in autonomous mode according to changing supply and demand. The solar powered air conditioning unit operates with an absorption type refrigerating unit, high-output flat collectors and an automatic control system. All design values are achieved on start-up of the plant. ESA

N87-14778# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
VACUUM SUPERINSULATION (VSI) ELEMENTS FOR COVER IN LARGE HEAT STORAGE SYSTEMS Final Report, Jun. 1984
Dieter Seefeld and Horst Timm Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 93 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-007; ISSN-0340-7608; ETN-86-98288) Avail: NTIS HC A05/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 19.50

A floating and insulating cover to prevent heat losses from large hot water basins was developed. The cover is based on vacuum superinsulated elements. No tests were done. ESA

N87-14779# Brown, Boveri und Cie, A.G., Heidelberg (West Germany).
DEVELOPMENT OF SODIUM/SULFUR BATTERIES, PHASE 3 Final Report, Dec. 1984
Wilfried Fischer Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 212 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-059; ISSN-0340-7608; ETN-86-98770) Avail: NTI.. HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38

The properties of the cell components (solid electrolyte, Na and S-electrode, seal, cell casing with corrosion protection layer) were improved. Improved cell components were used to build advanced laboratory cells with an average life time of greater than 1000 cycles. Evacuated thermal enclosures filled with glass fibers and air cooling systems were developed. Battery components mentioned were utilized to construct experimental batteries, which operated in the laboratory and on a test vehicle. A first generation of technical cells is in production. Average values of specific energy and power are 165 Wh/kg and 195 W/kg. Cells were used to build 80 Wh/kg to 80 W/kg batteries. ESA

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N87-14780# Civil Aviation Authority, London (England). Chief Scientist's Div.
UNITED KINGDOM AIRCRAFT NOISE INDEX STUDY: MAIN REPORT
Peter Brooker, J. B. Critchley, D. J. Monkman, and C. Richmond Oct. 1984 231 p Prepared for Department of Transport, England
(DR-8402; ETN-86-98593) Copyright. Avail: Issuing Activity

The United Kingdom aircraft Noise and Number Index (NNI) was reassessed via noise measurements and questionnaires. Results confirm the usefulness of the Guttman annoyance scale. Noise events below 80 PNdB should be included in the index. A good fit to disturbance responses is given by 24 hr Leq, i.e., average noise over 24 hr. It is suggested that 55 Leq represent the onset of community disturbance, and 70 Leq a point of high disturbance. Continued use of NNI could lead to problems by underestimating the effect of less noisy aircraft, but arriving in greater numbers. ESA

N87-14781 Civil Aviation Authority, London (England).
NOISE DISTURBANCE AT NIGHT NEAR HEATHROW AND GATWICK AIRPORTS: 1984 CHECK STUDY
P. Brooker 1986 79 p Sponsored by the Department of Transport, England
(DR-8513; ETN-87-98594) Copyright. Avail: Issuing Activity

Sleep disturbance near London airports in 1984 was compared with results for 1979. The comparison confirms that the Leq measure of noise average is a good aircraft noise disturbance measure for evening and night. There is a stronger increase, with Leq, in aircraft attributed disturbance than in the total disturbance reported. In the original study there were indications of increased total disturbance at 65 Leq plus. Improvements in the aircraft noise climate make these difficult to detect. The total number of movements at night does not influence disturbance strongly. The noisier flights, which contribute most to the Leq noise energy, appear to determine reaction. ESA

N87-14782 Civil Aviation Authority, London (England). Chief Scientist's Div.
CEC JOINT STUDY OF COMMUNITY RESPONSE TO AIRCRAFT NOISE 1984: MAIN REPORT. THE INFLUENCE OF RESIDUAL NOISE ON DISTURBANCE FROM AIRCRAFT NOISE
I. D. Diamond, J. G. Walker, J. B. Critchley, and G. C. Richmond Jul. 1986 97 p Sponsored by the Commission of the European Communities and the UK Dept. of Transport Prepared in cooperation with Southampton Univ., England
(DR-8601; ETN-87-98595) Copyright. Avail: Issuing Activity

The influence of background noise on reported annoyance caused by aircraft noise near a regional airport was assessed. The validity of aircraft noise indices was studied. Attitude scales as measures of disturbance were examined. A methodology for studies of community annoyance by environmental noise was derived. Results show no clear evidence that the disturbance due to aircraft noise is influenced by background noise. The Leq measure of aircraft noise is recommended. Simpler scales than the Guttman can be used to quantify disturbance. ESA

N87-14783 Ministry of Defence, London (England).
REPORT OF SURVEY CARRIED OUT AT ARE SOUTH ARM SITE ROSYTH ON 10-14 DECEMBER 1984 TO DETERMINE THE LEVELS OF WELDING FUME AND GASES TO WHICH OPERATERS ARE BEING SUBJECTED
H. J. Mackay Mar. 1986 36 p
(MOD-103/86; MOD-D/Safety/21/141; BR99150; ETN-87-98621) Copyright. Avail: Issuing Activity

Working conditions in two welding shops were examined, and ways to improve them were suggested. ESA

N87-14784 Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Munich (West Germany).
NO2 CONVERSION DURING THE ATMOSPHERIC DISPERSION OF NITRIC OXIDES Final Report
Karl-Friedrich Knoche, Hans-Guenter Richard, Friedhelm Schneider, and Johannes Janicka May 1985 67 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BPT-1/86; BMFT-KBF-58; ISSN-0176-0777; ETN-87-98740) Copyright. Avail: Issuing Activity

A numerical model for the simulation of the coupled diffusion and reaction of nitric oxides in power plant plumes was developed. The method consists of three partial models for turbulent transport of nitric oxides, the chemical reaction, and the influence of turbulent fluctuations on the chemical reactions. The turbulent diffusivities were determined by a model, based on measured data. The chemical model includes the oxidation of NO by oxygen and ozone, and the photodissociation of NO2. The importance of further reactions was examined. The influence of turbulent fluctuations on the chemical reactions was considered via a transport equation. A comparison with measured concentrations shows applicability of the model. The influence of stack height, emitted mass of nitric oxides, atmospheric conditions, background ozone concentration, and solar flux are determined. ESA

N87-14785 Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Munich (West Germany). Bereich Projekttraegerschaften.
DETERMINATION OF THE TECHNICAL DEGRADATION OF NITROGEN OXIDES IN THE ATMOSPHERE Final Report [BESTIMMUNG DES CHEMISCHEN ABBAUS DER STICKOXIDE IN DER ATMOSPHAERE]
J. Drummond, D. H. Ehhalt, G. Huebler, F. J. Johnen, W. Junkermann, C. Kessler, A. Khedim, L. Kins, F. Meixner, D. Mihelcic et al 1985 137 p In GERMAN Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Kernsforschungsanlage, Juelich, West Germany
(BPT-3/86; ISSN-0176-0777; BMFT-KBF-52; ETN-87-98741) Copyright. Avail: Issuing Activity

Field and laboratory experiments were performed to investigate the chemical behavior of nitrogen oxides in the atmosphere and their influence on the atmospheric hydrogen radical budget. Comparison of the measured OH-concentration values with model calculations for atmospheric conditions shows that the model overstimates the concentration by a factor of 1.5 to 3, probably due to unknown radical loss mechanisms. The observed evolution of the NO3-radical concentration allows the determination of the atmospheric life of this species; the reaction between N2O5 and humid surfaces is shown to be the most important NO3-radical trap. The chemical reactions of HNO2 in the atmosphere which lead to accelerated smog production were clarified. The height and latitude distribution of NO, NO2, HNO3, NOy, O3, CO, CH4, peroxy-acetyl-nitrate, and hydrocarbons were obtained. ESA

N87-14786# Sandia National Labs., Albuquerque, N. Mex. Ground Motion and Seismic Div.
CLIMATOLOGICAL ASSESSMENT OF AIRBLAST PROPAGATIONS FROM EXPLOSION TESTS AT WHITE SANDS MISSILE RANGE
J. W. Reed Aug. 1986 62 p
(Contract DE-AC04-76DP-00789)
(DE86-014942; SAND-86-1346) Avail: NTIS HC A04/MF A01

Atmospheric acoustic refraction, by upper air temperature and wind strata, may duct and focus explosion airblast waves, sometimes causing nuisance level damages at several times the normal distances. Large explosion tests at White Sands Missile Range may thus threaten window damage, with possible hazard from falling glass, in various surrounding communities. To establish what explosion yields may be reasonably contemplated (with acceptable delays) and the best time of year for these tests, a climatological assessment has been prepared from five years of upper air weather observations made at the Albuquerque and El Paso airports. Each twice-daily radiosonde balloon observation from each station was analyzed to show the refracting sound velocity versus height structure for all directions, the attenuating or amplifying effect on the yield-dependent explosion airblast wave, and the blast overpressure expected at each incremental area of a polar coordinate grid out to 325 km distance. It was assumed that tests would be conducted near the warmest time of the day. Population census data allowed an estimation of the number of window panes exposed in each area. A relationship between overpressure and window breakage probability was then used to calculate the expected damage from a test under the observed weather condition. Assuming that 25 broken windows could be accepted, each day was categorized as good, bad, or marginal. Climatological results are shown in various formats for the occurrences of these categories. The broad conclusions are: The best season for testing is from May through September (based on this single test consideration). In summer, there should be few delays for 500 ton HE equivlent explosions, but about a 40% likelihood of not firing 8 kt HE on a given day, and very little chance of ever firing 50 kt HE. DOE

N87-14787# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Dept. of Physics.
LASER-PHOTOACOUSTIC SPECTROSCOPY OF AIR POLLUTANTS
St. Bernegger, P. L. Meyer, and M. W. Sigrist 1985 21 p Submitted for publication
(M-19; ETN-86-98571) Avail: NTIS HC A02/MF A01

A stationary step-tunable CO laser and a step-tunable CO2 laser installed in a trailer were used for photoacoustic spectroscopy (PAS) of pollution. The photoacoustic chamber in both setups is a resonant cell which permits measurements in the flow mode.

The high sensitivity which corresponds to a background-limited absorption coefficient of 0.00000001/cm, and the wide dynamic range of PAS are discussed. Good agreement between calculated and measured spectra for the CO laser wavelength range is obtained for various pollutants. Problems which arise due to the simultaneous oscillation of adjacent CO laser transitions and due to the interfering water vapor absorption are outlined. Spectral analysis of an HNO3/H2O vapor mixture and its decomposition products is discussed. Excellent agreement between PA spectra of certified gas mixtures and literature data for the CO2 laser transitions is obtained. An analysis of indoor air samples from the laboratory and from a garage is presented. ESA

N87-14788# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Chemie 3: Atmosphaerische Chemie.
INVESTIGATIONS ON DRY DEPOSITION AND EMISSION OF ATMOSPHERIC NO, NO2 AND HNO3 TO AND FROM NATURAL SURFACES Thesis - Cologne Univ., West Germany
K.-D. Hoefken, F. Meixner, K. P. Mueller, and D. H. Ehhalt Apr. 1986 207 p In GERMAN; ENGLISH summary
(JUEL-2054; ISSN-0366-0885; D-38; ETN-87-98878) Avail: NTIS HC A10/MF A01

Emission and dry deposition of the atmospheric nitrogen oxides NO, NO2 and HNO3 from and to vegetated and base soils and a natural water surface were determined. The influence of soil temperature, soil water content, and atmospheric mixing ratio of nitrogen oxide on its exchange at the soil-air boundary was evaluated. Emission and deposition of NO and NO2 exist simultaneously. The vertical flux of NO and NO2 is a coupling of two parts, directed from the atmosphere to the soil and vice versa. Resulting net fluxes of up to +or- 1000 micro g/sqm/hr were found, depending on atmospheric and soil parameters. For HNO3 only deposition was found. Its velocities range from 0.4 to 0.8 cm/sec (base soil and lake water surface) up to 6 cm/sec (soil with sugar beets) independent of temperature and soil water content. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N87-14789# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
BASIC PROGRAM FOR EDDY CORRELATION IN NON-SIMPLE TERRAIN
R. T. McMillen Jun. 1986 41 p
(PB86-227501; NOAA-TM-ERL-ARL-147) Avail: NTIS HC A03/MF A01 CSCL 04A

A system is described which calculates vertical fluxes of heat, moisture, momentum, and certain atmospheric pollutants in a manner which permits the eddy correlation technique to be used in more complex terrain than was normally thought possible. The system is assembled from commercially available components and is simple to operate. The required computer program allows for flexibility and interchangeability of instrumentation without recompilation. Sample results are presented, and the sensitivities of the calculated quantities to coordinate rotation and to mean removal time are examined. A description of the program and a complete program listing are included as appendices. GRA

N87-14790# Atomic Weapons Research Establishment, Aldermaston (England).
REDETERMINATION OF EARTHQUAKE BODY-WAVE MAGNITUDES (m SUB b) USING ISC BULLETIN DATA
R. C. Lilwall and J. M. Neary (Polytechnic of the South Bank, London (England).) Apr. 1986 41 p
(AWRE-O-21/85; ISBN-85518167-2; BR99318; ETN-86-98379) Avail: NTIS HC A03/MF A01

Some 100,000 bodywave magnitudes for earthquakes occurring in the period 1964 to 81 inclusive were computed. Compared with the existing conventional magnitude estimates, the values are relatively free from bias introduced by data truncation, station amplitude terms, and errors in the amplitude-distance curve. The redeterminations should enable more accurate predictions of seismicity globally and regionally and of amplitudes at individual recording stations. ESA

N87-14791# Danish Space Research Inst., Lyngby.
ROCKET OBSERVATION OF E-B-FIELD CORRELATIONS SHOWING UP- AND DOWNGOING POYNTING FLUX DURING AN AURORAL BREAKUP EVENT
F. Primdahl, G. Marklund (Royal Inst. of Tech., Stockholm (Sweden).), and I. Sandahl (Kiruna Geophysical Inst. (Sweden).) Nov. 1986 31 p
(Rept-7-86; ISSN-0109-6605) Avail: NTIS HC A03/MF A01

On January 27, 1979 the S23H rocket was launched from ESRANGE, Kiruna, Sweden, shortly after the onset of an intense auroral breakup over Northern Scandinavia. The high altitude and short range trajectory of the rocket carried the instruments twice through the same magnetic flux tubes demonstrating some time variation imposed on a spatial structure. Several regions of intense Birkeland current sheets were penetrated, and examples are given where the northward electric field showed anticorrelation, correlation, as well as no correlation with the westward magnetic field perturbations. This is interpreted as examples of down-flowing and up-flowing electromagnetic energy as well as regions of little exchange of energy between the magnetosphere and the ionosphere. Author

N87-14792# Pennsylvania State Univ., University Park. Dept. of Mineral Engineering.
A STUDY TO MONITOR MICROSEISMIC ACTIVITY TO DETECT SINKHOLES Final Report
H. Reginald Hardy, Jr., Robert M. Belesky, Marek Mrugala, Edward J. Kimble, and Mardell E. Hager Jul. 1986 200 p
(Contract DTFA01-84-C-0005)
(DOT/FAA/PM-86/34) Avail: NTIS HC A09/MF A01

A research program was undertaken at Capital City Airport, New Cumberland, Pennsylvania to evaluate the feasibility of using seismic and acoustic emission/microseismic (AE/MS) techniques as a means of locating sinkhole-prone areas and monitoring current sinkhole stability. The report includes a review of the Captial City Airport sinkhole problem; a brief review of sinkhole phenomena and possible techniques for sinkhole detection and monitoring; a detailed description of the field studies carried out at the Capital City Airport site; a sinkhole monitoring philosophy based on the results of the airport studies; and an outline of additional studies required for the development of a prototype sinkhole-monitoring system. The results indicate that a combination of seismic and AE/MS techniques provide a feasible method for sinkhole detection and stability monitoring. Seismic techniques based on surface-wave attenuation provide a valid and convenient method for delineating sinkhole-prone areas. Conventional, low-frequency AE/MS techniques have been found satisfactory for locating simulated sinkhole activity. The location of AE/MS activity using zonal techniques was found to be very applicable to the problem of sinkhole location. However, high, rather than low, frequency AE/MS techniques may be more suitable for monitoring at such sites due to the inherent background noise. Preliminary laboratory studies associated with the development of dual-transducer waveguide systems for detecting AE/MS activity under runway pavements and in infield areas were encouraging. Author

N87-14793# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
A SIMULATION FEASIBILITY STUDY
Kevin L. Witte Jun. 1986 15 p
(AD-A169651; USAFETAC/PR-86/003) Avail: NTIS HC A02/MF A01 CSCL 04/1

This document presents the results of a pilot study performed for the Air Force Aerospace Medical Research Laboratory to determine the feasibility of simulating Pasquill Stability Index, wind

speed, cloud cover, and wind direction for a diffusion model. The author concluded that the wind speed and direction should be modeled together, but that cloud cover should be modeled separately because of the low correlation between cloud cover/wind speed and cloud cover/wind direction. Wind speed and cloud cover, according to the author, can be used to simulate a Pasquill Stability Index. GRA

N87-14794# Massachusetts Inst. of Tech., Cambridge. Earth Resources Lab.

DEVELOPMENT OF ULTRASONIC MODELLING TECHNIQUES FOR THE STUDY OF SEISMIC WAVE SCATTERING DUE TO CRUSTAL INHOMOGENEITIES Final Report, 13 Apr. 1983 - 30 Sep. 1985

M. N. Toksoz, Anton M. Dainty, and Edmond E. Charrette, III Mar. 1986 81 p

(Contract F19628-83-K-0027)

(AD-A170062; AFGL-TR-86-0078) Avail: NTIS HC A05/MF A01 CSCL 08/11

The scattering of Rayleigh waves form surface features has been investigated using three dimensional ultrasonic models at frequencies near 1 MHz and two-dimensional finite difference calculations. The models were constructed of aluminum blocks and an aluminum powder epoxy composite of lower density and seismic velocity. The aluminum has similar seismic velocities and density to igneous and metamorphic rocks while the composite is similar to sedimentary materials. Kilometers in the earth are scaled to millimeters in the models; this makes 1 MHz in the models equivalent to 1 Hz in the earth, typical of the frequencies observed in regional seismograms. Relief on the models was a few millimeters, the order of a wavelength. The relief was restricted to an isolated circular mesa of composite on a metal block and an isolated circular depression both unfilled and filled with composite. Calculations were made for similar situations by the finite difference method; comparisons indicated a general similarity in the seismograms, allowing us to use the finite difference calculations to gain physical insight into the scattering process. Topography alone produces attenuation due to scattering into reflected surface waves and body waves. Adding low velocity composite to the model considerably changes this picture. The Rayleigh wave energy is strongly trapped in the low velocity material on the surface and produces strong reverberation as it bounces around in the mesa or valley. GRA

N87-14795# Air Force Geophysics Lab., Hanscom AFB, Mass.

A SIMPLE MODEL OF AURORAL ELECTRODYNAMICS COMPARED WITH HILAT MEASUREMENTS

M. A. Doyle, W. J. Burke, D. A. Hardy, P. F. Bythrow, and F. J. Rich 1 Jun. 1986 8 p

(AD-A170320; AFGL-TR-86-0146) Avail: NTIS HC A02/MF A01 CSCL 04/1

Simultaneous measurements of cold plasma drift velocities, magnetic field perturbations, and precipitating electron fluxes with instrumentation on board the HILAT satellite provide an opportunity to correlate Birkeland current densities, electric fields, and ionospheric conductivities in the region of an auroral form. Typical plasma parameters such as ion density, temperature, and composition and electron density and temperature are also available. As the satellite crossed a bright auroral form, recorded by the auroral imager mapper, the particle spectrometer detected a 2 orders of magnitude increase in the flux of $>$ keV electrons. The precipitating electrons of this event produced a double inverted V structure embedded in the large scale, region 2 field aligned current sheet. This paper presents calculations of the component of the electric field along the satellite trajectory and perpendicular to the auroral form, given the Birkeland current feeding the auroral form and conductivities derived from particle precipitation data. This electric field component emerges as a solution to the current continuity equation in the infinite current sheet approximation with appropriate boundary conditions. Emphasis is placed on accurately representing the Birkeland current density in the region of the bright auroral form. In general, large-scale features are well represented by the calculations. GRA

N87-14796# Colorado Univ., Boulder.

STATE-RESOLVED DYNAMICS OF ION-MOLECULE REACTIONS IN A FLOWING AFTERGLOW Final Report, 1 Oct. 1982 - 30 Sep. 1985

Stepen R. Leone, Veronica M. Bierbaum, and G. B. Ellison 27 Nov. 1985 18 p

(Contract F49620-83-C-0013)

(AD-A170839; AFOSR-86-0592TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

An extensive set of studies was undertaken utilizing infrared chemiluminescence, visible chemiluminescence and laser induced fluorescence detection to explore the dynamics of ion molecule reactions in a flowing afterglow apparatus. Detailed product vibrational state distributions were determined for a variety of reactions including heavy atom transfer in polyatomic systems, charge transfer reactions and proton transfer reactions. Absolute branching ratios for production of electronically excited oxygen atoms were measured for a reaction of atmospheric importance. The rotational state distribution of an ion in an electric drift field has been characterized and a study of the velocity distribution has been initiated. GRA

N87-14797# Fachhochschule, Hamburg (West Germany). Fachbereich Vermessungswesen.

A METHOD FOR THE INTERPRETATION OF GRAVITY ANOMALIES USING THREE-DIMENSIONAL MODELING Final Report, Sep. 1984

Joachim Apel Bonn, West Germany Bundesministerium fuer Forschung und Technologie Feb. 1986 92 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-86-020; ISSN-0340-7608; ETN-86-98194) Avail: NTIS HC A05/MF A01 Fachinformationszentrum, Karlsruhe, West Germany DM 19.50

Gravity measurements were interpreted for the exploration of raw material deposits. A procedure which enables a quick prediction of the mass excess and the spatial distribution of a deposit was developed. The method includes the measuring data acquisition, the computation of all corrections, topographic reductions, trend removal, and the interpretation of the local anomaly by a 3D-model optimization. The number of parameters could clearly be reduced using a model of mass centers; the problem of the initial model was solved, and the convergence of the optimization process was improved. The computation of the model field is extremely fast. It is possible to look for equivalent mass distributions by assuming a special area for the expected masses. The procedure gives immediately the results of the gravity interpretation. ESA

N87-14798# Science Research Council, Chilton (England). Rutherford Appleton Lab.

A STUDY OF THE UTILITY OF SOLAR OCCULTATION MEASUREMENTS FOR DETERMINATION OF ATMOSPHERIC COMPOSITION Final Report

Paris, France ESA Oct. 1985 205 p

(Contract ESA-6152/85-NL-BI)

(ESA-CR(P)-2232; ETN-86-98533) Avail: NTIS HC A10/MF A01

The utility of the solar occultation method for measuring atmospheric gas concentrations from space is assessed. Knowledge of middle atmosphere composition and relevant spectroscopy is reviewed. Applications are considered in terms of measurement accuracy requirements, as is the problem of retrieving species concentrations which show a diurnal variability. The capabilities of the method are evaluated in terms of spectral resolution, signal to noise ratios, systematic errors, and spectral interference. Mission requirements, in particular pointing accuracy and stability, are compared with capabilities. Orbit configurations are studied to determine the frequency, duration, and latitude coverage of occultations. From these data the suitability of each orbit for solar occultation missions is judged and ideal orbits are discussed. ESA

N87-14799# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.

THULE MAGNETIC RESULTS, 1981 Progress Report

1985 70 p
(ISBN-87-7478-263-0; ETN-86-98550) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the magnetic laboratory during 1981 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given. ESA

N87-14800# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
THULE MAGNETIC RESULTS, 1982 Progress Report
1985 73 p
(ISBN-87-7478-264-9; ETN-86-98551) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the magnetic laboratory during 1982 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given. ESA

N87-14801# Danish Meteorological Inst., Copenhagen. Div. of Geophysics.
THULE GEOPHYSICAL OBSERVATORY MAGNETIC RESULTS, 1984 Progress Report
1985 72 p
(ISBN-87-7478-266-5; ETN-86-98555) Avail: NTIS HC A04/MF A01

The results of the standard observations carried out at the magnetic laboratory during 1984 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given. ESA

N87-14802# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Meteorologische Modelle.
FORCING MECHANISMS OF MOUNTAIN-VALLEY CIRCULATIONS IN THE INN-VALLEY (ALPS)
Gerhard Wagner Jun. 1986 179 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-28; ISSN-0171-1342; ETN-87-98857) Avail: NTIS HC A09/MF A01

With a three-dimensional numerical model the thermally induced valley flow system in a large mountain valley of the Alps is computed. The interaction of the valley flows with the thermally induced mountain circulation above the Alps is investigated. The same model is applied for the alpine domain with reduced resolution. The results are imposed at the boundaries of the model for the valley, they are validated compared to the MERKUR experiment. The observed valley flows can be explained by this model only if the interaction of the valley flow system with the mountain flows is taken into account. ESA

N87-14803# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 502, JUNE 1986. PART 1: (PROMPT REPORTS). DATA FOR MAY 1986, APRIL 1986 AND LATE DATA
H. E. Coffey, ed. Jun. 1986 111 p
(Contract N00014-86-F—0049)
(PB86-224011; SGD-502-Pt-1; LC-79-640375-Pt-1; ISSN-0038-0911) Avail: NTIS HC A06/MF A01 CSCL 03B

Solar-Geophysical Data Number 502, June 1986; Part 1 (Prompt Reports); Data for May 1986, April 1986, and Late Data, contains the following; a detailed index for 1985 to 1986; data for May 1986--(IUWDS alert periods (Advance and worldwide), Solar flares, Solar radio emission, Standard mean solar magnetic field); data for April 1986--(Solar active regions, Sudden ionospheric disturbances, Solar radio spectral observations, Cosmic ray measurements by neutron monitor, Geomagnetic indices, Radio propagation indices); and late data-Cosmic ray measurements by neutron monitor, Geomagnetic indices, Calcium plague data. GRA

N87-14804# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 502, JUNE 1986. PART 2: (COMPREHENSIVE REPORTS). DATA FOR DECEMBER 1985 AND MISCELLANEA
H. E. Coffey, ed. Jun. 1986 31 p
(Contract N00014-86-F-0049)
(PB86-224029; SGD-502-Pt-2; ISSN-0038-0911; LC-79-640375-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Solar-Geophysical Data number 502, June 1986; Part 2 (Comprehensive Reports); Data for December 1985, and Miscellanea, contain the following: a detailed index for 1985-86; data for December 1985--(Meudon carte synoptique, Solar radio bursts at fixed frequencies, Solar x-ray radiation from GOES satellite, Mass ejections from the sun Active prominences and filaments); and miscellaneous data--(Solar proton events January 1976 - May 1986). GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N87-14805# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
STABILITY OF A SHEAR MODEL IN WHICH PERTURBATIONS MOVE WITH THE MEAN LOCAL FLOW
E. E. Gossard Jun. 1986 17 p
(PB86-232469; NOAA-TM-ERL-WPL-136) Avail: NTIS HC A02/MF A01 CSCL 04B

The report is a companion to an earlier report in which the relationship between the variances of temperature and vertical velocity and their dependence on the height gradient of temperature was examined by solving the equations of motion, continuity and energy for a special linearized model. The report continues the analysis of a model and examines the morphology of the perturbations and their dynamic stability. Remote sensing systems such as acoustic sounders and radars usually depend on what is commonly called Bragg Scatter from turbulent inhomogeneities in the refractive index of the medium. The power backscattered is proportional to the power at the Bragg scale in the spectrum of the refractive index. These quantities, potentially measurable by the radars, are of great interest if they can be related to the mean gradients with height of properties, such as temperature that are of interest to the meteorologist. GRA

N87-14806# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
REMOTE DETECTION OF AIRCRAFT ICING CONDITIONS USING MICROWAVE RADIOMETERS
Martin T. Decker, Ingrid A. Popa Fotino, and Judith A. Schroeder Jun. 1986 46 p
(PB86-229507; NOAA-TM-ERL-WPL-137) Avail: NTIS HC A03/MF A01 CSCL 04B

The potential role of ground-based remote sensors in the defection of atmospheric conditions conducive to aircraft icing is evaluated. Measurements of liquid water along a line of sight and profiles of atmospheric temperature were made by microwave radiometers located at Stapleton International Airport, Denver, Colorado. Radiometer data and sky cover observations for a 2-yr period were correlated with icing occurrences reported by aircraft pilots in the area. GRA

N87-14807# Naval Postgraduate School, Monterey, Calif.
PARAMETERIZATION OF OVERWATER HORIZONTAL WIND VARIABILITY Report, Oct. 1984 - Mar. 1986
Gordon E. Schacher Jun. 1986 222 p
(AD-A169331; NPS-61-86-014) Avail: NTIS HC A10/MF A01 CSCL 04/2

Data from four overwater diffusion experiments have been analyzed to parameterize the overwater horizontal wind variability. The parameterization involves three production mechanisms: shear, buoyancy, and a larger scale process loosely refered to as

mesoscale. All three processes have been parameterized for averaging times from 1 min to 1 hour. The variability has also been parameterized in term of the surface layer stability, which is found to be an unsatisfactory parameter. The results are applicable to the overwater coastal regime. Author (GRA)

N87-14808# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
DEPENDENCE OF C2 SUB n(C2 SUB t) IN THE ATMOSPHERIC BOUNDARY LAYER ON CONVENTIONAL METEOROLOGICAL VARIABLES Final Report, 15 Sep. 1983 - 14 Dec. 1985
Edward Ryznar and Joseph A. Bartlo Jan. 1986 149 p
(Contract F19628-83-K-0040)
(AD-A169478; Rept-021082-F; AFGL-TR-86-0013) Avail: NTIS HC A07/MF A01 CSCL 04/2

The objective of the research was to develop methods for estimating optical turbulence in the atmospheric boundary layer with conventional meteorological variables. There are many such variables, considered here to be those observed and reported hourly from weather stations throughout the world. An additional requirement imposed by the research, however, is that the variables chosen, compared to the others, also have the most pronounced effects on optical turbulence in the atmospheric boundary layer. The two variables that meet the requirements of conventionality and effectiveness are cloudiness and wind speed. Data sets consisting of boundary-layer measurements of the structure function parameter for refractive index, C squared sub n (measured optically or calculated with various methods of estimating the temperature structure parameter C squared sub T), and meteorological variables, including solar radiation are analyzed. The work concentrates on describing optical turbulence only for sky conditions known to produce the largest values of C squared sub n times C squared sub T in the boundary layer, both in daytime and at night, in that only conditions with a cloudless sky or with scattered clouds (half or less of the sky cloud-covered) are analyzed. In addition to the restriction in terms of cloudiness, the results are applicable mainly to optical turbulence conditions over land surfaces with small amounts of soil moisture. GRA

N87-14809# Connecticut Univ., Storrs. Dept. of Renewable Natural Resources and Civil Engineering.
FIELD STUDY OF WIND THROUGH AND OVER A FOREST EDGE Final Report, 2 Jan. 1984 - 1 Jan. 1986
D. R. Miller and J. D. Lin 7 Apr. 1986 38 p
(Contract DAAG29-84-K-0017)
(AD-A169491) Avail: NTIS HC A03/MF A01 CSCL 04/2

Three-dimensional miniature wind sensors that are stationary and have a high frequency response were developed and used to measure the wind structure inside and outside a forest edge. Extensive data sets were taken at different distances from the edge with the sensors arranged vertically through the canopy on movable towers both inside and outside the edge. Horizontally spaced sensors showed the flow inside the forest was correlated spatially at spacing less than 4 m. More persistent autocorrelations at higher wind speeds demonstrated that larger eddies penetrated the canopy at higher wind speeds. Measurements above the canopy demonstrated a decay of Reynolds stress with decreasing height in the roughness sublayer. Velocity spectra demonstrated that mechanical turbulence is generated by the canopy at frequencies of about 1 hz. Comparisons of in-forest profiles with the wind blowing into and out of the forest showed the effects of the edge on the turbulent intensities, streamwise and cross stream Reynolds stresses. The flow through the edge intensified the turbulences below and above the forest canopy. Conditional sampling analyses demonstrated the sweeping and ejection mechanism of large scale momentum transfer is mosifed by the edge. Measurements outside the edge show the evolution of intermittent stagnation eddies against the edge. GRA

N87-14810# Army Engineer Topographic Labs., Fort Belvoir, Va.
WORLD WEATHER EXTREMES: REVISION
Pauline Riordan and Paul G. Bourget Dec. 1985 89 p
(AD-A170138; ETL-0416) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report consists of a worldwide map of weather extremes and a separate map for the United States and Canada, with comments on the reliability of the records shown. Included are highest and lowest temperatures, largest temperature variations, greatest and least amounts of precipitation for various durations, maximum precipitation variabilities, greatest thunderstorm frequencies, highest and lowest atmospheric pressures, highest solar radiation, largest and heaviest hailstones, greatest snowfalls, highest wind speeds, high dew point, and most frequent occurrences of fog. Where appropriate, the value for the highest and lowest annual mean is also given. As far as possible, the records are taken from official sources, and all of them are documented. Conditions of site, instrumentation, observational procedure, and other factors such as environmental and meteorological conditions pertinent to the reliability of extremes are discussed. Author (GRA)

N87-14811# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL Final Report, Jan. - May 1979
C. R. Mechoso, M. J. Suarez, K. Yamazaki, A. Kitoh, and J. A. Spahr Jan. 1986 408 p
(Contract N00014-80-K-0947; NSF ATM-82-18215; F59-551)
(AD-A170188; NEPRF-CR-86-01) Avail: NTIS HC A18/MF A01 CSCL 04/2

This report presents a series of medium-range (10-day) forecasts performed with the UCLA general circulation model (GCM). For most of the forecasts we have used more than one version of the GCM with different horizontal resolutions and vertical extents. The impact of these model characteristics on the accuracy of the forecasts, therefore, can be assessed. Section 2 contains an outline of the UCLA GCM. Descriptions of the dataset and the initialization procedure are given in Section 3. An inventory of cases and models used for each case is in Section 4. The major part of this report consists of the forecast results, presented as maps of sea-level pressure (SLP) and geopotential (Z) fields at selected pressure levels. GRA

N87-14812# Illinois State Water Survey, Urbana.
A THEORETICAL FRAMEWORK FOR EXAMINING GEOGRAPHICAL VARIABILITY IN THE MICROPHYSICAL MECHANISMS OF PRECIPITATION DEVELOPMENT Final Report, 15 Jan. 1982 - 14 Jan. 1985
David B. Johnson Jun. 1986 101 p
(Grant AF-AFOSR-0079-82)
(AD-A170317; AFOSR-86-0484TR) Avail: NTIS HC A06/MF A01 CSCL 04/2

The overall goal of this study was to identify and evaluate the environmental or microphysical parameters that control the efficiency of the various mechanisms of precipitation development. Such evaluations can then be used as the basis for studying, or even predicting the effect of geographical or climatological differences between regions on the microphysical mechanisms of precipitation development. This study included work on warm rain initiation and development, ice multiplication, snowflake aggregation, and the growth of graupel by collection of supercooled water droplets. During the first year of the study, work concentrated on the warm-cloud studies and began on the investigation of snowflake aggregation. With the extension of the study into a third year, additional investigations were made on snowflake aggregation and preliminary investigations were begun to extend these studies into mixed-phase (riming) precipitation. The studies of riming and graupel development were quite successful and indicated that the studies of warm rain initiation and development could be extended to include mixed-phase precipitation development. In general, the study identified a number of key parameters that control the microphysical development of precipitation. The two primary parameters that need to be measured on a climatological basis are cloud base temperature and cloud droplet concentration. Other key parameters include the degree of entrainment and stability of the environment. GRA

N87-14813# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
OBSERVING THE SYNOPTIC STRUCTURE OF TWO MOISTURE BURSTS M.S. Thesis
James R. Schaefer Dec. 1985 158 p
(AD-A170670; AFIT/CI/NR-86-70T) Avail: NTIS HC A08/MF A01 CSCL 04/2

The moisture burst is characterized by large amounts of cloudiness emanating from tropical regions and often affecting middle latitude regions. Due to data scarcity, the study of moisture bursts near their origin is difficult. Supplementary data available during the First GARP Global Experiment make such a study feasible. Through the use of in situ observations and computer-generated model analyses, this thesis presents results of a synoptic case study of two moisture bursts. Satellite-derived data are shown to be useful in this region, although lack of certain satellite radiance channels during the time period precludes their use. The FGGE IIIb model analyses are first proven to be reliable by comparison with satellite observations and are then used extensively. GRA

N87-14814# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DYNAMIC AND THERMODYNAMIC CHARACTERISTICS OF A MICROBURST-PRODUCING STORM IN COLORADO DETERMINED FROM JAWS (JOINT AIRPORT WEATHER STUDIES) DUAL-DOPPLER DATA Ph.D. Thesis
Robert G. Hughes 1986 232 p
(AD-A170673; AFIT/CI/NR-86-69D) Avail: NTIS HC A11/MF A01 CSCL 17/9

Some dynamic and thermodynamic structures of a microburst-producing storm which occurred on 14 July 1982 in Colorado were studied in detail. Dual-Doppler radar data collected during the Joint Airport Weather Studies (JAWS) project at Denver's Stapleton International Airport, were objectively analyzed to produce a 3D wind field. The analyzed domain had dimensions of 10 km by 10 km by 8.5 km centered on the microburst. Vertical velocities were computed by integrating the anelastic continuity equation downward from the storm's top. A variational approach was then employed to adjust the derived three-dimensional wind components. Subsequently, fields of deviation perturbation pressure, density and virtual temperature were recovered from a detailed wind field using the three momentum equations. These retrieved fields were subjected to internal consistency checks to determine the level of confidence before interpretation. GRA

N87-14815# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
TIME SERIES PREDICTION OF HURRICANE LANDFALL Ph.D. Thesis
Thomas F. Curry May 1986 153 p
(AD-A170742; AFIT/CI/NR-86-75D) Avail: NTIS HC A08/MF A01 CSCL 04/2

Greater accuracy is required in predicting hurricane landfall in order to insure timely evacuation. A significant result of this research is the classification of past storms by time series stationarity category which relates to direction of movement. Also, a psi-weight representation of the forecast is used to develop a bivariate Normal confidence ellipse for the threshold autoregressive model. It is shown that the landfall of North Atlantic hurricane and tropical storms can be accurately predicted by modeling the storm track as a bivariate (latitude and longitude) fifth-order autoregressive process. A threshold approach is used to allow model parameters to change as the storm moves to a new region of the ocean. For test cases, operational average 72 hours prediction error is at least three standard deviations below the average error of the official forecasts issued by the National Hurricane Center. GRA

N87-14816# International Centre for Theoretical Physics, Trieste (Italy).
IMPLICATIONS OF THE SPATIAL FINITENESS OF MESOSCALE METEOROLOGICAL FIELDS
A. Shafee and S. Shafee Jul. 1985 13 p Prepared in cooperation with Dacca Univ. (Bangladesh)
(DE86-702777; IC-85/106) Avail: NTIS (US Sales Only) HC A02/MF A01

By constraining the perturbed velocity and temperature fields to vanish exponentially radially, the coupled system of equations can be seen to give a unique form of the temperature lapse rate of the atmosphere which corresponds to the unstable regime. We then show that finite disturbances in the condensation rate, or equivalently smooth horizontal variation of the large scale fields, does not allow such localization of steady state perturbations, though in the time dependent case the possibility remains. DOE

N87-14817# Sofreavia, Paris (France).
THE DATA CIRCULATION MISSION IN THE METEOSAT 2000 PROGRAM
Paris, France ESA Dec. 1985 138 p
(Contract ESA-6164/85-F-RD(SC))
(ESA-CR(P)-2221; ETN-86-98101) Avail: NTIS HC A07/MF A01

The Meteosat 2000 Program data which should circulate on the satellite channels, the corresponding telecommunications facilities, the basic user stations, and operating and commercialization policy are discussed. It is asserted that the Program should be designed as a priority for professional use by meteorological services and not, as previously, for all users. Apart from the station directly receiving raw satellite data, a single user station receiving image data and observation and processed data, all in digital mode, can be conceived. The dissemination program should be split between two 166.6 kbit/sec transmission channels: a Europe channel transmitting the meteorological information meeting the specific requirements for the member countries of the Program; and a World Weather Watch channel transmitting the meteorological information requested by WMO members in the Meteosat coverage area. Data should be ciphered. ESA

N87-14818# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaffen.
DEVELOPMENT OF TEST REFERENCE YEARS (TRY) FOR CLIMATIC REGIONS IN THE FEDERAL REPUBLIC OF GERMANY Final Report, Jun. 1984
Klaus Bluemel, Eberhard Hollan, Malte Kaehler, Rainer Peter, and Axel Jahn Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 169 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-051; ISSN-0340-7608; ETN-86-98767) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM

Test Reference Years (TRY) were worked out for 12 different regions covering the whole of the Federal Republic of Germany. The TRY's are planned for use in simulating the thermal behavior of buildings, the operation of heating and air-conditioning systems, control of lighting, solar energy systems and similar technical systems. A TRY is a collection of hourly data for the application of important meteorological parameters over a whole year. The TRY curve corresponds to the characteristic weather conditions of the appropriate TRY-region. The annual and seasonal averages of the meteorological parameters in the TRY correspond to a great extent to the climatic averages worked out over many years for the year, spring, summer, autumn, and winter. About 15% of the 12 TRY's worked out consist of actual measured values and 85% is data generated on the basis of measured values. The latter are both interpolations of 3-hourly measured values to hourly intervals and radiation values completed using a radiation model. ESA

N87-14819# World Meteorological Organization, Geneva (Switzerland).
INTERNATIONAL LIST OF SELECTED, SUPPLEMENTARY AND AUXILIARY SHIPS
1986 391 p In ENGLISH and FRENCH
(WMO/OMM-47-ED-86; ETN-86-98567) Avail: MF A01; print copy available at WMO, Geneva, Switzerland

The WMO International List of Selected, Supplementary and Auxiliary Ships contains information, valid on 1 January 1986, supplied by countries in the Global Observing System. The participation of countries in the WMO Voluntary Observing Ship Scheme and statistical data on upper-air observation equipment,

telecommunication facilities, and number of radio operators on board is outlined. An alphabetical index of ships' names gives the country heading and the type of ship station (selected, supplementary or auxiliary) under which a given ship appears in the International List. ESA

N87-14820# World Meteorological Organization, Geneva (Switzerland).
COMPOSITION OF THE WMO Quarterly Report, July 1986
Jul. 1986 171 p In ENGLISH and FRENCH
(WMO/OMM-5; ETN-86-98568) Avail: MF A01; print copy available at WMO, Geneva, Switzerland

Member nations of the World Meteorological Organization, its regional associations, and its technical commissions are listed. ESA

N87-14821# Stockholm Univ. (Sweden). Dept. of Meteorology.
RESULTS FROM PREDICTION OF CLOUDINESS WITH A LIMITED AREA MODEL
Ulla Hammarstrand and Hilding Sundqvist (Bergen Univ. (Norway).) Jun. 1986 32 p
(Contracts NFR-G-GU-8494-100; NFR-G-GU-8494-101)
(DM-48; ISSN-0349-0467; ETN-87-98556) Avail: NTIS HC A03/MF A01

A parameterization scheme for stratiform and convective condensation with cloud water content and cloud cover as dependent variables was implemented in a limited area model for weather prediction. Verifications of the forecast fields are performed utilizing synoptic data and satellite measurements. The predicted cloud covered area coincides well with the observed, and the amounts of accumulated precipitation also agree with observations. However, the convergence zone, associated with the cloud and precipitation area, moves too slowly. This is caused by errors in the overall synoptic forecast. There are no observations of cloud water content available and the realism of this field can therefore only be judged indirectly by comparison to the precipitation rate. ESA

N87-14822# European Space Agency, Paris (France).
DETERMINATION OF ATMOSPHERIC PARAMETERS BY AN AIRBORNE BACKSCATTER PROBE
Hans-Eberhard Hoffmann Jul. 1986 68 p Original language document was announced as N86-28583
(ESA-TT-982; DFVLR-FB-85-61; ETN-87-98827) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM

Measurements performed with a backscatter probe on an icing research aircraft are discussed. This probe transmits the white light of a flashlight; the backscattered light is received in three different wavelength ranges. The backscattered signals were calibrated for measuring standard visibilities outside clouds by an integrating nephelometer, and for measuring standard visibilities in clouds by contrast measurements. Information on particle size distributions is obtained from the values of the backscattered signal if the liquid water content is measured synchronously. Solid particles differ from fluid particles by amplitude and type of backscattered signal. Examples of measurement results are shown. ESA

N87-14823# Environmental Protection Agency, Research Triangle Park, N.C.
EFFECTS OF GRIDDED PRECIPITATION BIAS ON WET DEPOSITION PREDICTIONS
T. L. Clark, R. L. Dennis, D. Palka, M. P. Olson, and E. C. Voldner Aug. 1986 17 p Prepared in cooperation with Program Resources, Inc., Research Triangle Park, N.C. and Atmospheric Environment Service, Downsview, Ontario
(PB86-230091; EPA/600/D-86/171) Avail: NTIS HC A02/MF A01 CSCL 04B

Spatially averaged precipitation amounts are used by many regional models to predict sulfur wet deposition amounts across the same grid cells. Gridded precipitation amounts routinely calculated by the CMC were compared to 1980 seasonal and annual precipation amounts at 41 to 60 precipitation chemistry sites in eastern North America. For each period, the mean gridded amounts were found to be lower than the mean amounts at the sites, as much as 22.9%. To assess the effects of this bias in the gridded precipitation amounts on the predictions of sulfur wet deposition amounts, 1980 weekly predictions of the Atmospheric Environment Service LRT Model at 18 eastern North American grid cells were recalculated using site precipitation amounts. GRA

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N87-14824 Defence Research Information Centre, Orpington (England).
METHODS OF REMOTE EVALUATION OF CHLOROPHYLL CONCENTRATION IN THE SEA
K. Malachowski Jan. 1986 30 p
(DRIC-T-7652; BR100206; ETN-87-98617) Copyright. Avail: Issuing Activity

Passive methods of determining the depth of light penetration and the effective chlorophyll concentration, the connection between the concentration of phytopigments and sea color, atmospheric correction, and determining chlorophyll concentration using passively-induced fluorescence (including an active laser method) are discussed. A passive satellite method of analyzing sea color is recommended. ESA

N87-14825# SACLANT ASW Research Center, La Spezia (Italy).
NUMERICAL SIMULATIONS OF THE CIRCULATION OF THE EASTERN MEDITERRANEAN
Despina Grillaki and Steve Piacsek Nov. 1985 30 p
(AD-A170219; SACLANTCEN-SR-92) Avail: NTIS HC A03/MF A01 CSCL 08/3

Oceanographic observations have shown that the surface circulation in the eastern Mediterranean consists of the zonal North African Current along with systems of gyres and rings both north and south of the Current. A large cyclonic gyre occurs between Cyprus and Crete, and another between Greece and Libya. A weaker, quasi-permanent eddy is formed in the Ionian sea and is intensified by the flow through the Strait of Sicily. An anticyclonic ring occurs south of the North African Current in the Gulf of Sirte and another occurs in the southwest Levantine Sea. The reduced-gravity model (one active layer) of Hurlburt and Thompson has been adapted and applied to the semi-enclosed basin of the eastern Mediterranean. Using monthly averages of climatological wind stresses and the estimate of the annual mean flow through the Strait of Sicily, numerical simulations of the circulation in the eastern Mediterranean basin have been carried out. Model runs both with and without inflow through the Straits have been performed. The overall results agree with the observations. They show the presence of the North African Current, two persistent cyclonic gyres of varying strengths and two anticyclonic rings. GRA

N87-14826# Rhode Island Univ., Kingston. Graduate School of Oceanography.
THE GULF STREAM DYNAMICS EXPERIMENT. INVERTED ECHO SOUNDER DATA REPORT FOR THE APRIL 1983 TO JUNE 1984 DEPLOYMENT PERIOD Summary Report, Apr. 1983 - Jun. 1984
Karen L. Tracey and D. Randolph Watts Apr. 1986 237 p
(Contract N00014-81-C-0062; Grant NSF OCE-82-01222)
(AD-A170757; URI/GSO-TR-86-4) Avail: NTIS HC A11/MF A01 CSCL 08/10

The Gulf Stream Dynamics Experiment was conducted in the region just northeast of Cape Hatteras from September 1983 to May 1985 to study the propagation and growth characteristics of Gulf Stream meanders. Data collected as part of the field

experiment included inverted echo sounders, current meter moorings, and AXBT survey flights. This report documents the inverted echo sounder data collected from September 1983 to June 1984, as well as additional measurements made from April to September 1983. Time series plots of the half-hourly travel time and low-pass filtered thermocline depth measurements are presented for twenty-two instruments. Bottom pressure and temperature, measured at seven of the sites, are also plotted. Basic statistics are given for all the data records shown. Maps of the thermocline depth field in a 240 km by 460 km region are presented at daily intervals. GRA

N87-14827# Danish Meteorological Inst., Copenhagen.
THE ICE CONDITIONS IN THE GREENLAND WATERS, 1979
1985 128 p In ENGLISH and DANISH
(ISBN-87-7478-261-4; ETN-86-98316) Avail: NTIS HC A07/MF A01

Monthly ice charts for the entire Greenland region and local reconnaissance charts are presented. ESA

N87-14828# Centre National d'Etudes Spatiales, Toulouse (France). Radar and Localization Dept.
MARGINAL ICE ZONE EXPERIMENT (MIZEX) 1986 VARAN-S DATA SET
N. Lannelongue, D. Vaillant, J. Perbos, and W. J. Campbell Nov. 1985 61 p
(CNES-85/187T/CT/DRT/TIT/RL; ETN-86-98581) Avail: NTIS HC A04/MF A01

A refurbished B-17 flew 5 radar ice mapping missions during MIZEX-East 84. Four of the missions were flown with extensive cloud cover. After each flight, the VARAN X-band radar data was processed as rapidly as possible and a cartoon drawn. The cartoons were telemailed to ships. The average elapsed time from the end of the flight to the transmission to the ships of the ice/ocean cartoon was 7 hr. On the last 3 missions B-17 radar data was transmitted in real-time to the ships, to help them locate ice/ocean eddies, large ice floes, ice edge, etc. The B-17 with its long range and slow speed proves to be excellent for this kind of remote sensing. ESA

N87-14829# Institute of Oceanographic Sciences, Wormley (England).
DISPERSION OF TRACERS BY THE OCEANIC EDDY FIELD MODELLING PROGRAMME Interim Report, Apr. 1986
K. J. Richards 1986 27 p Sponsored by Department of Energy, England
(IOS-229; DOE/RW/86.086; PECD7/9/216; ETN-86-98608) Avail: NTIS HC A03/MF A01

A numerical model to study the dispersion of tracers by the oceanic eddy field in a possible nuclear waste disposal site was developed. The horizontal and vertical structure of the eddies and how this structure is influenced by the bottom topography were investigated. It is found that hills and valleys have a strong effect on the eddies above them. The flow close to the bottom tends to be steered by the height contours. The surface and bottom flows become decorrelated and the vertical variation of the kinetic energy of the eddies is increased with higher topographic features. Topographic effects are large even for small hills and valleys (height 50 m or less) which suggests that topography needs to be taken into account in any study of oceanic eddies for all regions of the ocean. ESA

51 LIFE SCIENCES (GENERAL)

N87-14830# Naval Medical Research Inst., Bethesda, Md.
INVESTIGATION OF POTENTIAL BEHAVIORAL EFFECTS OF EXPOSURE TO 60 Hz ELECTROMAGNETIC FIELDS Final Report, Mar. 1982 - Apr. 1985
John R. Thomas, John Schrot, and Abraham Liboff Dec. 1985 69 p
(AD-A169650; NMRI-85-63) Avail: NTIS HC A04/MF A01 CSCL 05/10

To analyze potential behavioral effects produced by exposures to 60 Hz electric and magnetic fields, animals were exposed to a range of linearly polarized magnetic fields of .5 to 5 gauss, with and without the combination of a 1 kv/m electric field. The animals performed on a multiple fixed-ratio (FR) differential reinforcement of low rate (DRL) reinforcement schedule that required responding on a lever to produce food pellets. The effects of the above fields were also studied on the multiple FR DRL schedule performance of animals administered representative drugs from two psychoactive drug classes, amphetamine and chlordiazepoxide. Under the present experimental exposure conditions and durations, exposures to the 60 Hz electromagnetic fields produced no systematic changes in the behavior of the animals of the multiple FR DRL schedule. No systematic effects were observed on the behavioral effects of either amphetamine or chlordiazepoxide, at the doses explored, by any of the exposures to the magnetic fields alone or in combination with the electric field. When animals were exposed to a low-level (.5 gauss) 60 Hz magnetic field combined with a low-level static magnetic field they consistently exhibited changes in the rate and pattern of responding during the DRL component of the multiple FR DRL reinforcement schedule. GRA

N87-14831# Washington Univ., Seattle.
AFFERENT MECHANISMS OF MICROWAVE-INDUCED BIOLOGICAL EFFECTS Annual Report, 1 Jun. 1985 - 31 May 1986
Henry Lai Jul. 1986 4 p
(Contract N00014-80-C-0354; RR0-4108)
(AD-A169979) Avail: NTIS HC A02/MF A01 CSCL 06/18

We studied the effects of 2450 MHz circularly polarized microwave irradiation on central nervous system functions. Pulsed (microsecond, 500 pps) microwaves decreased high affinity sodium-dependent choline uptake in the hippocampus and frontal cortex of the rat. The effect on hippocampal choline uptake was blocked by pretreatment with narcotic antagonists. Continuous-wave microwaves of the same power density decreased choline uptake in the frontal cortex only. Furthermore, we found that the effects of pulsed microwaves on central cholinergic activity are classically conditionable to cues in the exposure environment. The hypothesis that some of the neurological effects of pulsed microwave irradiation are caused by its effect on the auditory system was investigated. Effects of pink noise and pulsed microwaves were compared. GRA

N87-14832# Army Medical Research Inst. of Infectious Diseases, Fort Detrick, Md.
TECHNIQUE FOR CARDIOVASCULAR MONITORING IN AWAKE TETHERED RATS Interim Report
Gerald W. Parker and Dale G. Martin 16 Jul. 1986 25 p
(AD-A170246) Avail: NTIS HC A02/MF A01 CSCL 06/14

We have developed a tethering system for use in awake, freely moving rats that allows for repeated measurement of either cardiac output or direct arterial blood pressure and electrocardiogram (ECG). Cardiac output was measured by the thermodilution technique by using a thermocouple probe and polyethylene tubing surgically implanted in the aortic arch and superior vena cava, respectively. Arterial blood pressure and ECGs were monitored via a carotid arterial catheter and teflon-coated, stainless steel wire electrodes place subcutaneously on the extremities. The catheters, wires, and thermocouple probe were passed subcutaneously to the dorsal cervical area and exteriorized. The animals were then attached to a rodent jacket/spring tether system and allowed to recover for at least 24 to 48 hours before experimental procedures were initiated. In 49 rats, arterial blood pressures and ECGs were analyzed. Similarly, cardiac output was measured in 27 rats. GRA

N87-14833# Oak Ridge National Lab., Tenn. Chemical Technology Div.
PHOTOBIOLOGICAL HYDROGEN PRODUCTION IN GREEN ALGAE AND PHOTOSYNTHETIC BACTERIA

E. Greenbaum 1986 3 p Presented at the GRI Basic Research Contractor's Review Meeting on Gaseous Fuel Synthesis From Inorganic Resources, Palo Alto, Calif., 15 Oct. 1986
(Contract DE-AC05-84OR-21400)
(DE86-015918; CONF-8610137-1) Avail: NTIS HC A02/MF A01

We have shown that, under appropriate physiological conditions, certain freshwater and marine green algae are capable of splitting water to molecular hydrogen and oxygen in a sustained steady-state reaction. In these algae, the gaseous-fuel-producing reaction can be driven by light throughout the visible portion of the solar emission spectrum, including the long wavelength (red) 700-nm region. No external energy sources are required. DOE

N87-14834# European Space Agency, Paris (France).
ON THE EFFECTS OF X IRRADIATION ON BACILLUS SUBTILIS SPORES IN A DRY AND WET SYSTEM
Eduard Woizenko Apr. 1986 78 p Original language document was announced as N86-15864
(ESA-TT-968; DFVLR-FB-85-44; ETN-87-98819) Avail: NTIS HC A05/MF A01; original German version available from DFVLR, Cologne, West Germany DM 29

Bacillus subtilis spores were irradiated to study the influence of intracellular water and to explain the modulating role of water in the development of biological radiation damage. The effects of repair deficiency in mutants regarding sensitivity to radiation in dry and wet systems were studied to explain the damage process in correlation with cell water content. The experiments were verified in multiplication rate and lag phase curves. Wild and mutant species are more sensitive to ionizing radiation in a dry medium than in a wet medium. The water content used as a radiation protective substance reduces inactivation. Rec+ species (wild species) is more sensitive to ionizing radiation under extremely dry conditions and in a vacuum than Rec- species (mutants) due to a reduced repair ability. Recspecies deficient in the Rec A gene develop other repair processes to compensate for damage. The results show the variety of the cell repair processes. ESA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N87-14835# Midwest Research Inst., Kansas City, Mo.
EFFECTS OF 60 Hz FIELDS ON HUMAN HEALTH PARAMETERS Final Report, 9 Sep. 1985 - 14 Mar. 1986
M. R. Cook, C. M. Maresh, and H. D. Cohen Aug. 1986 61 p Sponsored by Health Effects Research Lab.
(PB86-231297; EPA/600/1-86/006) Avail: NTIS HC A04/MF A01 CSCL 06S

Specific results of research on the effects of exposure to 60-Hz electric and magnetic fields have often been contradictory and difficult to replicate. The study reported here used quantitative exercise testing techniques to evaluate whether increases in metabolism, caused by moderate steady-state exercise prior to exposure to real or sham fields, would clarify potential field effects. The feasibility of the methods and procedures used was clearly established. The finding indicated that the physical recovery process following moderate steady-state exercise performed under no exposure conditions, was the same in real and sham fields. Of the variables examined, only cardiac inter-beat interval (IBI) was altered by 2 hr of field exposure. A statistically significant increase in IBI (equivalent to a 3 beat/min decrease in heart rate) was found when subjects were exposed to the real field after sitting quietly prior to exposure. This replicates earlier research, in which IBI was increased following a longer period of field exposure. The results suggest that future studies should examine a broader range of the continuum of human arousal and physiological activation. GRA

N87-14836# Army Research Inst. of Environmental Medicine, Natick, Mass.
INFLUENCE OF A 3.5 DAY FAST ON PHYSICAL PERFORMANCE RUNNING HEADING: FASTING AND PERFORMANCE
Jospeh Knapik, Bruce Jones, Carol Meredith, and William J. Evans 1986 30 p
(AD-A169597) Avail: NTIS HC A03/MF A01 CSCL 06/19

The influence of a 14 h fast or a 3.5 day fast on physical performance was investigated in 8 young men. In both conditions they were tested for isometric strength, isokinetic strength (elbow flexors, 30 degs/sec and 180 degs/sec), anaerobic capacity and aerobic endurance. Anaerobic capacity was evaluated by having subjects perform 50 rapidly repeated isokinetic contractions of the elbow flexors at 180 degs/sec. Aerobic endurance was measured as time to volitional fatigue during a cycle ergometer exercise at 45% VO2 max. Measures of VO2, V sub E, heart rate, and ratings of perceived exertion were obtained prior to and during the cycle exercise. The 3.5 day fast did not influence isometric strength, anaerobic capacity or aerobic endurance, but isokinetic strength was significantly reduced (approx. 10%) at both velocities. VO2, V sub E and perceived exertion were not affected by fasting. Fasting significantly increased heart rate during exercise but not at rest. It was concluded that there are minimal impairments in physical performance as a result of a 3.5 day fast provided there is little physical activity during the fasting period. GRA

N87-14837# Army Research Inst. of Environmental Medicine, Natick, Mass.
A COMPUTERIZED SYSTEM FOR MEASURING DETECTION SENSITIVITY OVER THE VISUAL FIELD
John L. Kobrick, Adrien R. Lussier, Stephen Mullen, and Calvin Witt Jun. 1986 22 p
(AD-A169600; USARIEM-M-42/86) Avail: NTIS HC A02/MF A01 CSCL 05/8

An important aspect of the ongoing visual process is the detection of events both in the central and the peripheral field areas. Although the central line of sight involving the retinal fovea is clearly the locus of greatest visual resolution under photopic viewing conditions, the capability for detection of visual events is also present to a lesser degree in virtually all areas of the visual field. It has been shown that the zone of best overall detection sensitivity is distributed in an ovaloid configuration about the horizontal axis of the visual field, with maximum sensitivity occurring along that axis. A device is described for comprehensively measuring the capability of human operators to detect and react to visual signals occurring at a variety of locations throughout the functional visual field. The system is completely automated and computerized, and provides both documentation files and descriptive graphics of the operator's performance immediately upon completion of testing. Sensitivity of detection can be measured for three stimulus colors (red, yellow, green), in a testing configuration which mimics commonplace surveillance of the ordinary viewing field. An abbreviated listing of the main operating program software is provided. GRA

N87-14838# Illinois Univ., Champaign. Cognitive Psychophysiology Lab.
THE EVENT-RELATED BRAIN POTENTIAL AS AN INDEX OF INFORMATION PROCESSING AND COGNITIVE ACTIVITY: A PROGRAM OF BASIC RESEARCH Annual Progress Report, 1 Jan. 1985 - 31 Dec. 1985
Emanuel Donchin and Arthur Kramer 20 Feb. 1986 658 p
(Contract F49620-85-C-0041)
(AD-A170794; CPL-86-1) Avail: NTIS HC A99/MF A01 CSCL 05/10

We review a program of research designed to understand the event-related brain potential (ERP) so that it can be used as a tool in the study of cognitive function and in the assessment of man-machine systems. We have conducted a series of studies on the functional significance of ERPs and have demonstrated the P300 component is related to memory processes. We have used measures of the same component to evaluate workload, to time mental processes, to study reciprocity of processing resources, and to extend theories of human information processing. We have

also made technical advances in the analysis of the distribution of electrical potentials across the scalp. GRA

N87-14839# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE EFFECTS OF PHYSICAL CONDITIONING ON HEAT TOLERANCE IN CHEMICAL DEFENSE GEAR M.S. Thesis
Michelle M. Nauss Jun. 1986 78 p
(AD-A170903; AFIT/CI/NR-86-108T) Avail: NTIS HC A05/MF A01 CSCL 06/19

Today the threat of chemical warfare is real. The only effective defense is the use of chemical defense gear and gas masks. Since they render chemical warfare gases and liquids impermeable to penetration, they also prohibit sweat evaporation in conditions of thermal stress and thus, contribute to heat illness development. Historically, it has been the hot, humid tropics where United Nation's peacekeeping forces have been called, thus the use of chemical defense gear in these regions is a realistic possibility and heat illness could affect the outcome of any mission carried out there. The human body only operates within a narrow range of core temparatures and heat illness is the result of a breakdown in homeostasis. Adequate hydration, acclimitization to heat, low body weight, young age, low alcohol intake, and physical fitness all contribute to heat tolerance. This proposal attempts to look specifically at the effect of physical conditioning on heat tolerance in chemical defense gear as a possible solution to the heat stress problem. Basic trainee graduates attending technical training schools at Lackland AFB, Texas, will be tested for maximum oxygen uptake (VO2max) and heat tolerance time (HTT) in chemical defense gear on bicycle ergometers at Brooks AFB, Texas. Half of these subjects will be physically conditioned for 12 weeks. GRA

N87-14840# State Univ. of New York, Buffalo. Hyperbaric Research Lab.
EFFECTS OF STATIC LUNG LOADING ON CARDIORESPIRATORY FUNCTION IN SUBMERGED EXERCISING SUBJECTS AT DEPTH Final Report, 1 Jan. 1978 - 30 Dec. 1985
Claes E. Lundgren 20 Jun. 1986 28 p
(Contract N00014-78-C-0205)
(AD-A170914) Avail: NTIS HC A03/MF A01 CSCL 06/19

The overall rationale for the work performed under this contract was that an important aspect of man's usefulness under water is the ability to perform physical work. Compared to terrestrial conditions, the diving environment often restricts this ability. The primary limitations to submerged work appear to be cardiorespiratory. This notion is supported by investigations in which exercise at depth was limited by dyspnea, i.e. shortness of breath. Several potentially important factors behind this dyspnea could be envisioned. These factors were: increased respiratory flow resistance due to high gas densities at depth; resistance in the diver's breathing gear; and static lung loading due to depth differences between the diver's chest and his breathing gear. GRA

N87-14841# Oak Ridge National Lab., Tenn. Biology Div.
RADIATION EFFECTS IN SPACE
R. J. M. Fry 1986 16 p Presented at the 26th Committee on Space Research Meeting, Toulouse, France, 30 Jun. 1986
(Contract DE-AC05-84OR-21400)
(DE86-013257; CONF-8606145-2) Avail: NTIS HC A02/MF A01

The paper discusses the radiation environment in space that astronauts are likely to be exposed to. Emphasis is on proton and HZE particle effects. Recommendations for radiation protection guidelines are presented. DOE

N87-14842# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
SOME EVIDENCE ON NON-TRANSMISSIBILITY OF ACUTE UPPER RESPIRATORY DISEASE AND RELATED MATTERS
J. Watkins, Fred Hoyle, and N. C. Wickramasinghe May 1986 49 p
(Preprint-115; ETN-86-98361) Avail: NTIS HC A03/MF A01

Acute upper respiratory tract infections account for a significant level of morbidity and sometimes mortality throughout the world. The reported incidence of morbidity ranges from 23 to 62% of the population being affected in any six month period. Such infections are mainly of viral origin, the principal viruses implicated being Influenza A, Respiratory Syncytial Virus, Parainfluenza, Adenovirus, Rhinovirus, Enterovirus, Coxsackie, and Echo virus. These viruses are isolated the world over and show well-defined patterns of global incidence. Despite a coordinated international endeavor directed at tracking down both the temporal and spatial behavior of such viruses, there seems at the present time to be little understanding with regard to their origin and mode of propagation. It is shown here that a wide range of observational data fit well to a model involving atmospheric incidence and transport of these viruses. ESA

N87-14843# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EFFECT OF CHANGES IN CEREBROSPINAL FLUID PRESSURE ON THE LABYRINTH IN TERMS OF TYMPANIC MEMBRANE DISPLACEMENT
J. J. Tweed, R. J. Marchbanks, and A. M. Martin 1986 81 p
(Grant MRC-G8422151N)
(ISVR-TR-135; ETN-86-98369) Avail: NTIS HC A05/MF A01

It is shown that a pressure change of 30 mm saline in the perilymph fluid can be detected by the tympanic membrane displacement (TMD) measurement system, as a change in the mean volume displacement and maximum inward volume displacement of the tympanic membrane during contraction of the stapedius muscle. The change in perilymphatic pressure, measured in terms of the reflex TMD, faithfully reflects the changes is cerebrospinal fluid (CSF) pressure brought about by controlled changes of posture. A patent cochlear aqueduct is the most probable route for this pressure transfer from the CSF to the perilymph fluid. However, at least 12% of the ears tested show no change in perilymphatic pressure with a change in CSF pressure. The technique can detect high intracochlear fluid pressures in patients with hydrops. The technique may have a significant bearing on the investigation of the time-course of forms of paroxys mal vertigo such as Meniere's Syndrome. ESA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N87-14844 Defence Research Information Centre, Orpington (England).
A MODEL OF TYPING PERFORMANCE WITH RESPECT TO MENTAL LOAD FACTORS
Frank M. Kuehn, Klaus H. Schmidt, and Wolfgang Laurig Aug. 1986 17 p
(DRIC-T-7770; BR100138; ETN-87-98618) Copyright. Avail: Issuing Activity

A model for the analysis of computer user behavior in the transcription of given text material or commands is presented. The typing activity is modeled as being partitioned into the perception and encoding of text material; storing this material; and the preparation, execution, and control of the motor output. Experiment subjects were required to read and retype strings. Under the influence of mental load factors (string length and string type) and the subject level of practice two different behavioral strategies in text transcription can be described: a sequential one and a serial one, explained by the model. Results indicate task-dependent limits of the mental capacity of the subjects. ESA

N87-14845*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATIONS OF COMPUTER-GRAPHICS ANIMATION FOR MOTION-PERCEPTION RESEARCH
Dennis R. Proffitt (Virginia Univ., Charlottesville.) and Mary K. Kaiser Sep. 1986 14 p

(NASA-TM-88335; A-86327; NAS 1.15:88335) Avail: NTIS HC A02/MF A01 CSCL 92B

The advantages and limitations of using computer animated stimuli in studying motion perception are presented and discussed. Most current programs of motion perception research could not be pursued without the use of computer graphics animation. Computer generated displays afford latitudes of freedom and control that are almost impossible to attain through conventional methods. There are, however, limitations to this presentational medium. At present, computer generated displays present simplified approximations of the dynamics in natural events. Very little is known about how the differences between natural events and computer simulations influence perceptual processing. In practice, the differences are assumed to be irrelevant to the questions under study, and that findings with computer generated stimuli will generalize to natural events. Author

N87-14846*# National Aeronautics and Space Administration, Washington, D.C.

ON THE PILOT'S BEHAVIOR OF DETECTING A SYSTEM PARAMETER CHANGE

Noboru Morizumi and Haruo Kimura Dec. 1986 27 p Transl. into ENGLISH from Japan Society for Aeronautical and Space Sciences Journal (Japan), v. 33, no. 380, 1985 p 531-539 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-4005)

(NASA-TM-88536; NAS 1.15:88536; ISSN-0021-4663) Avail: NTIS HC A03/MF A01 CSCL 92B

The reaction of a human pilot, engaged in compensatory control, to a sudden change in the controlled element's characteristics is described. Taking the case where the change manifests itself as a variance change of the monitored signal, it is shown that the detection time, defined to be the time elapsed until the pilot detects the change, is related to the monitored signal and its derivative. Then, the detection behavior is modeled by an optimal controller, an optimal estimator, and a variance-ratio test mechanism that is performed for the monitored signal and its derivative. Results of a digital simulation show that the pilot's detection behavior can be well represented by the model proposed here. Author

N87-14847# EEG Systems Lab., San Francisco, Calif.

NEUROCOGNITIVE PATTERN ANALYSIS OF AUDITORY AND VISUAL INFORMATION Interim Report, 24 Mar. 1984 - 31 Jan. 1986

Alan S. Gevins 15 Feb. 1986 63 p

(Contract F49620-84-K-0008)

(AD-A170202; AFOSR-86-0495TR) Avail: NTIS HC A04/MF A01 CSCL 05/10

The EEG Systems Laboratory has been actively improving the measurement of neuroelectric substrates of human higher brain functions. The short-term objective has been to use the EEG to predict decrements in performance consequent to attentional lapses or fatigue. The long-term objective is to develop new technologies for enhancing cognitive abilities. The laboratory continues to test subjects in highly controlled paradigms. The paradigms test elementary cognitive and perceptuomotor functions critical for flying high performance aircraft and for performing other tasks with a high cognitive loads. Data are being analyzed from an interdisciplinary, inter-laboratory study of operational fatigue. This unique set of data consists of 57 channels of neurophysiological, physiological and behavioral data recorded from 4 Air Force fighter test pilots performing several cognitive and perceptuomotor tasks specially designed to require a high commitment of attention, memory, judgement and motor coordination. Recordings were made in 3 sessions dealing with task learning, operational fatigue (about 16 hours of continuous performance), and automatization of task performance. GRA

N87-14848# Air Force Human Resources Lab., Brooks AFB, Tex.

UTILIZATION OF PSYCHOMOTOR SCREENING FOR USAF PILOT CANDIDATES: INDEPENDENT AND INTEGRATED SELECTION METHODOLOGIES Final Report, Mar. 1978 - Aug. 1984

V. P. Bordelon and Jeffrey E. Kantor Jul. 1986 35 p

(AD-A170353; AFHRL-TR-86-4) Avail: NTIS HC A03/MF A01 CSCL 05/9

Two tests of psychomotor ability (hand-eye coordination) previously developed by the Air Force Human Resources Laboratory were validated against USAF Undergraduate Pilot Training (UPT) performance. Tests which significantly predicted UPT eliminations and differentiated between psychomotor tests were evaluated, including using the tests by themselves as an additional selection gate and combining the scores from the tests with other normally available selection information. The combined approach proved most accurate, and three Integrate Pilot Candidate Selection Models (IPCSMs) were developed using combinations of the psychomotor tests, Air Force Officer Qualifying Test scores, grades from the Flight Screening Program and biographical data. Comparisons among the IPCSMs were made and recommendations for implementation were presented. GRA

N87-14849# Dalhousie Univ., Halifax (Nova Scotia).

VISUAL SENSITIVITIES AND DISCRIMINATIONS AND THEIR ROLES IN AVIATION Interim Report, Oct. 1984 - Sep. 1985

David Regan Mar. 1986 42 p

(Grant AF-AFOSR-0030-84)

(AD-A170418; AFOSR-86-0464TR) Avail: NTIS HC A03/MF A01 CSCL 05/10

A device has been developed (MIDAPT) that tests a subject's ability to track a target's motion in depth. The test has been encouragingly successful in predicting intersubject differences of pilots' flying performance in high-performance jet aircraft and in simulators. We report evidence that human observers' acute discrimination of differences in size (about 5%) and orientation (about 0.3 deg) is achieved by comparing the outputs of two or more neurons, each of which is sensitive to a rather broad range of sizes and orientations. We suggest that the human visual pathway contains size-opponent and orientation-opponent mechanisms, and that this can explain why subjects easily unconfound orientation, size and contrast in spite of the fact that the firing of cortical neurons is affected by all three parameters. We measured subjects' ability to detect a camouflaged object that was visible only when moving, and compared these data with similar measurements for conventional objects that were brighter than their surroundings. These findings may be relevant to low-level flight, for example in helicopters, where ground features may be virtually indistinguishable except when moving. Monocular ability to judge the direction of motion in depth was investigated by measuring the effect of adaptation to different directions of motion in depth for a target viewed with one eye. GRA

N87-14850# Los Alamos National Lab., N. Mex.

TRILEVEL INTERACTION DESIGN MODEL FOR PILOT PART-TASK TRAINING

J. H. Roman, R. A. Pistone, and M. L. Stoddard 1986 6 p Presented at the Annual Meeting of the Human Factors Society, Dayton, Ohio, 30 Sep. 1986

(Contract W-7405-eng-36)

(DE86-012428; LA-UR-86-2244; CONF-8609105-1) Avail: NTIS HC A02/MF A01

Development of effective, scenario-driven training exercises requires both an instructional design and a delivery system that match the subject domain and needs of the students. The Training Research Team at Los Alamos National Laboratory conducts research and development of prototype training systems. One of the Team's efforts is a joint research project, supported with funding and behavioral science guidance from the Army Research Institute, to develop a prototype part-task trainer for student helicopter pilots. The Team designed a trilevel interaction model and a Level III interactive videodisc delivery system for this project. The model, founded on instructional and psychological theory, should be transferable to other domains where part-task training is appropriate. DOE

N87-14851# Bundesministerium der Verteidigung, Bonn (West Germany).
INVESTIGATIONS ON INTERACTIONS BETWEEN THE FINE MOTOR CONTROL OF THE HAND AND ACHIEVEMENTS OF ATTENTIVENESS IN AIRMAN TYPICAL PROBLEMS
Erik D. Kozeny Jun. 1985 115 p In GERMAN; ENGLISH summary
(Rept-2/85; ETN-86-98214) Avail: NTIS HC A06/MF A01

Correlations between fine motor control of the hand and pilot attentiveness were investigated using psychomotor techniques. By demanding various fine motor control performances, different forms of reaction can be provoked, and in particular cases an additional stress even results in a reduction of the number of errors. The tested fine motor control performances are affected in very different ways by training of the same duration. The tested intellectual performance is not in all areas a linear-function of specific achievements of reaction and control, and the ascertainable correlation is not equidirectional in all areas of intelligence. These findings underline the importance of not only paying attention to equating the individual starting positions of subjects in aptitude tests fields, but also of taking into account the interdependence of training, motivation, and understanding of instructions. ESA

N87-14852# Centre d'Etudes et de Recherches Psychologiques Air, Saint Cyr (France). Base Aerienne 272.
PILOT APTITUDE EVALUATION SIMULATOR Final Report [LE SIMULATEUR D'EVALUATION DE L'APTITUDE AU PILOTAGE (SEVAP)]
M. C. Veron, A. D. C. Sallenave, S. G. C. Juilier, S. G. C. Bonnefous, and S. C. Arros 1 Apr. 1986 43 p In FRENCH
(Contract DRET-81-1201)
(ETN-86-98433) Avail: NTIS HC A03/MF A01

A psychotechnical evaluation procedure applicable to the initial selection of military pilot candidates is presented. The procedure includes a mobile platform, a pilot's cabin, and a double screen read-out system displaying analog and digital data. The computer program which implements the system is described. The initial evaluation of the selection procedure shows that it is apt to measure the division of attention. The predictive value evaluation must wait for military school results. The developed hardware is available to test other computer programs concerning different pilot psychological aptitude parameters. ESA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N87-14853 Civil Aviation Authority, London (England).
HELICOPTER PASSENGER WEIGH SURVEY, CONDUCTED AT ABERDEEN AIRPORT, NOVEMBER 1984
Feb. 1985 11 p
(CAA-Paper-85005; ISBN-0-86039-235-X; ETN-87-98599) Copyright. Avail: Issuing Activity

Over 1000 passengers flying to offshore platforms were weighed for use in drawing up operational guidelines for civil aviation. Average weight is 79.4 kg, plus 2.2 kg with survival suit. ESA

N87-14854# Person-System Integration, Inc., Alexandria, Va.
EXPERT SYSTEM DESIGN AID FOR APPLICATIONS OF HUMAN FACTORS IN ROBOTICS Final Report, 1 Sep. 1985 - 1 Apr. 1986
James McGuinness, Joseph Wagner, John M. Nichols, and Christopher J. Rhoads 12 Jun. 1986 242 p
(Contract N60921-85-C-0252)
(AD-A169632; PSI-K31-TR885) Avail: NTIS HC A11/MF A01 CSCL 09/2

Research was performed to provide the groundwork for an Expert System that will function as a design aid for robotics applications. The Expert System is entitled Human Factors-Robotics Expert System (HF-ROBOTEX). This effort involved a number of interrelated steps including an examination of state-of-the-art technology in the fields of Expert Systems, Human Factors, and Robotics. A design specification was written incorporating the knowledge gained to guide the development of the Expert System. HF-ROBOTEX specification employs a modular design using a microcomputer-based system technology. It consists of three elements: a user interface, a knowledge base, and an interference driver. The knowledge base is designed to incorporate the knowledge of experts and selected sections of current Human Factors Guidebooks/Handbooks. The selection of data sources was guided by a literature review, by inputs from Human Factors Engineers, as well as by professionals involved in the application of robotics and Expert Systems. The inference driver uses rules of reasoning (i.e., heuristics) to access, as well as interpret information in the knowledge base and generate conclusions. GRA

N87-14855# School of Aerospace Medicine, Brooks AFB, Tex.
ANTHROPOMETRY HANDBOOK Final Report, Sep. 1982 - Mar. 1984
Peter H. Gill Feb. 1986 109 p
(AD-A170298; USAFSAM-TR-85-108) Avail: NTIS HC A06/MF A01 CSCL 06/14

This report details the rationale (techniques and equipment used, and specific body measurements recommended) for the use of an anthropometry laboratory and body size measuring equipment which have been constructed to support the development of a comprehensive Cockpit and Equipment Integration Laboratory. GRA

N87-14856# Aeronautical Research Labs., Melbourne (Australia).
A LABORATORY EVALUATION OF LIQUID COOLED VESTS FOR NON-COMBATANTS Final Report, 1980 - 1985
Karen Nagle and B. A. Clark Apr. 1986 32 p
(AD-A170417; ARL/SYS-TM-87) Avail: NTIS HC A03/MF A01 CSCL 06/19

A laboratory experiment was used to assess the value of two commercial liquid cooled vests in alleviating some of the physiological and psychological effects of heat stress on human performance. For conditions of 55 C (dry bulb) and 55% relative humidity, both vests reduced the rate of rise of body temperature, heat storage rate, and mass loss due to thermoregulatory sweating of three subjects. All subjects stated that the vests provided some relief from heat stress, but no effects of heat stress on performance were demonstrated. It suggested that for noncombatant personnel, vests like those tested may provide a practical and economical way of alleviating some of the discomfort and adverse physiological effects of heat stress when environmental control is not practicable. Author (GRA)

N87-14857# Report Store, Lawrence, Kans.
ANTHROPOMETRIC COMPARISON - USA AND USSR Final Report, Jun. - Aug. 1986
B. Williams and Lee Wascher Sep. 1986 29 p
(Contract DAAL02-86-P-4734)
(AD-A173070; HEL-FIO-6/86) Avail: NTIS HC A03/MF A01 CSCL 06/14

This comparison of US/USSR anthropometric dimensions uses illustrations and table formats from the US Army Human Engineering Design Data Digest. US Army figures and tables are shown on the left page and USSR tables are shown on the right page with separate tables for men and women. Each table provides 5th and 95th percentile values in centimeters of Armenian, Russian, and Lithuanian populations. This comparison includes five sets of dimensions: Standing Body Dimensions, Seated Body Dimensions, Circumferences and Surface Dimensions, Head and Face Dimensions,and Anthropametric Data for Workspaces. Detail of some measurements varies between the two countries. USSR illustrations often show the skeletal measurement reference

points while US illustrations do not. Each country offers more or less detail on specific anthropometric measures. GRA

N87-14858# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
HUMAN FACTORS GUIDELINES AND METHODOLOGY IN THE DESIGN OF A USER COMPUTER INTERFACE: A CASE STUDY
R. E. Richards, W. E. Gilmore, and L. N. Haney 1986 6 p Presented at the Annual Meeting of the Human Factors Society, Dayton, Ohio, 30 Sep. 1986
(Contract DE-AC07-76ID-01570)
(DE86-013470; EGG-M-16986; CONF-8609105-3) Avail: NTIS HC A02/MF A01

In this case study, human factors personnel were requested to participate in a project team of programmers and operations specialists to design a cathode ray tube (CRT) display system for a complex process control application. This presentation describes the process and benefits obtained by incorporating human factors guidelines and methods in system design. Standard human engineering guidelines and techniques were utilized by the project team. In addition, previously published documents and research findings sponsored by the US Nuclear Regulatory Commission (USNRC) were used. Preliminary tasks involved a review of the draft plant procedures. Then, interviews with operators were conducted to establish the initial information for the displays. These initial requirements were evaluated against existing guidelines and criteria to determine the optimal presentation formats. Detailed steps of the approaches used, design decisions made, and tradeoffs that resulted in the final user acceptable design are discussed. DOE

N87-14859# Southampton Univ. (England). Inst. of Sound and Vibration Research.
WHOLE-BODY VIBRATION AND AIRCREW PERFORMANCE
M. J. Griffin, R. W. McLeod, M. J. Moseley, and C. H. Lewis Jan. 1986 67 p
(Contract MOD-AT/2040/0180)
(ISVR-TR-132; ETN-86-98366) Avail: NTIS HC A04/MF A01

The effects of aircraft vibration on vision and manual control performance were studied. Twenty-eight experiments, 16 investigating effects on vision and 12 investigating effects on manual control performance are summarized. ESA

N87-14860# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
LIFE SUPPORT AND ENERGY SUPPLY SYSTEMS FOR MANNED EUROPEAN RETURN SPACECRAFT (TECHNOLOGICAL REQUIREMENTS) [LEBENSHALTUNGS- UND ENERGIEVERSORGUNGSYSTEME FUER BEMANNTE EUROPAEISCHE RUECKKEHRFAHRZEUGE (TECHNOLOGIEANFORDERUNGEN)]
R. Reichert 1986 23 p In GERMAN Presented at ILA 86 Symposium, Hanover, West Germany, 6 Jun. 1986; sponsored by Hermann-Oberth-Gesellschaft e.V.
(ETN-87-98860) Avail: NTIS HC A02/MF A01

The requirements and technological preparations of the life support and energy supply subsystems for European manned missions are reviewed. Concerning life support systems, mission requirements, specifications, system components, requirements for extravehicular activities, and ESA technology programs are presented. In the field of energy supply (fuel cells), mission requirements, fuel cells and systems components, and ESA technological preparations are outlined. ESA

N87-14861*# Remic Corp., Elkhart, Ind.
DEVELOPMENT OF A COMMUNICATION SYSTEM COMPATIBLE WITH CHEMICAL PROTECTIVE CLOTHING AND EQUIPMENT Final Report
Benjamin D. Blood and Robert E. Radke 23 Jun. 1986 126 p
(Contract NAS8-36456)
(NASA-CR-177040; NAS 1.26:177040; AD-A170863; USCG-D-18-86) Avail: NTIS HC A07/MF A01 CSCL 06/17

The U.S. Coast Guard and NASA joined in a project to develop a communications system to operate inside protective suits used in chemical spill response. REMIC Corporation, of Elkhart, Indiana was awarded the contract by NASA for developing this communication system. Coast Guard Strike Teams were consulted to determine operational requirements for the communications system. The contractor also studied environmental problems, investigated the special needs and restrictions of the user, and developed possible package configurations. Various options were presented for Coast Guard consideration with a description of each choice's advantages and disadvantages. NASA and the Coast Guard determined that the suit communication system should be built into a separate light-weight low-profile garment which would not interfere with other equipment being worn. A number of microphone and control options were developed to increase the system's flexibility. Although primarily for totally-encapsulating suits, the system was also designed for use with lower level protective clothing or with ordinary attire. Coast Guard marine band frequencies (157 MHz) were selected for the transceivers and repeaters. Engineering models were presented studied, and modified during a series of review meetings. Prototype transceivers and repeaters were fabricated and delivered to the Coast Guard. Field tests with the USCG Pacific Strike Team at Hamilton AFB, California demonstrated that the communications system met the special needs of spill response personnel. Author (GRA)

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N87-14862*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PARAMETER ESTIMATION PROBLEMS FOR DISTRIBUTED SYSTEMS USING A MULTIGRID METHOD Final Report
Shlomo Taasan and Pravir Dutt Oct. 1986 20 p Submitted for publication
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178194; ICASE-86-65; NAS 1.26:178194) Avail: NTIS HC A02/MF A01 CSCL 62O

The problem of estimating spatially varying coefficients of partial differential equations is considered from observation of the solution and of the right hand side of the equation. It is assumed that the observations are distributed in the domain and that enough observations are given. A method of discretization and an efficient multigrid method for solving the resulting discrete systems are described. Numerical results are presented for estimation of coefficients in an elliptic and a parabolic partial differential equation. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N87-14863*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

REAL-TIME GARBAGE COLLECTION FOR LIST PROCESSING Patent Application
Robert L. Shuler, Jr. Filed 26 Jun. 1986 31 p
(NASA-Case-MSC-20964-1; NAS 1.71:MSC-20964-1;
US-Patent-Appl-SN-878916) Avail: NTIS HC A03/MF A01 CSCL 09B

In a list processing system, small reference counters are maintained in conjunction with memory cells for the purpose of identifying memory cells that become available for re-use. The counters are updated as references to the cells are created and destroyed, and when a counter of a cell is decremented to logical zero the cell is immediately returned to a list of free cells. In those cases where a counter must be incremented beyond the maximum value that can be represented in a small counter, the cell is restructured so that the additional reference count can be represented. The restructuring involves allocating an additional cell, distributing counter, tag, and pointer information among the two cells, and linking both cells appropriately into the existing list structure. NASA

N87-14864# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
FAULT TOLERANCE IN PARALLEL ARCHITECTURES Final Report, Jun. 1982 - Dec. 1985
F. G. Gray 30 May 1986 36 p
(Contract DAAG29-82-K-0102)
(AD-A170245; ARO-18803.14-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a proposed automatically reconfigurable cellular architecture. The unique feature of this architecture is that the reconfiguration control is distributed within the system. There is no need for global broadcasting of switch settings. This reduces the interconnection complexity and the length of data paths. The system can reconfigure at the request of the applications software or in response to detected faults. This architecture supports fault tolerant applications since the reconfiguration can be self-triggered from within. The complete reconfiguration process can proceed without external interference. Author (GRA)

N87-14865# North Carolina Univ., Chapel Hill. Operations Research and Systems Analysis.
QUEUEING ANALYSIS OF FAULT-TOLERANT COMPUTER SYSTEMS
V. F. Nicola (Duke Univ., Durham, N. C.), V. G. Kulkarni, and K. S. Trivedi Dec. 1985 25 p
(Contract DAAG29-84-K-0045; Grants AF-AFOSR-0132-84; NSF MCS-83-0200)
(AD-A170303; UNC/ORSA/TR-85-10; AFOSR-86-0388TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper analyzes a fault-tolerant computer system. The failure/repair behavior of the system is modeled by an irreducible continuous-time Markov chain. Jobs arrive in a Poisson fashion to the system and are serviced according to an FCFS discipline. A failure may cause the loss of the work already done on the job in service, if any; in this case the interrupted job is repeated as soon as the system is ready to deliver service. In addition to the delays due to failures and repairs, jobs suffer delays due to queueing. The authors present a queueing analysis of fault-tolerant systems and study the steady-state behavior of the number of jobs in the system. As a numerical example, they consider a system with two processors subject to failures and repairs. Author (GRA)

N87-14866# Lawrence Livermore National Lab., Calif.
POSTEXPERIMENTAL PLOTS WITH A HP 7550A PLOTTER
G. Koide 12 Aug. 1986 10 p
(Contract W-7405-eng-48)
(DE86-015501; UCID-20856) Avail: NTIS HC A02/MF A01

A high speed plotter is needed to quickly display data after and experimental run. For flexibility, speed, and intelligence, a HP 7550A plotter is used to draw up to four curves in color. The graphs of the data may be plotted against time or any other acquired data. Two different sizes of paper either 8.5 x 11 or 11 x 17 inches may be selected. Moreover telescopic views of a portion of the graph may be drawn. DOE

N87-14867# MATRA Espace, Toulouse (France).
ASSESSMENT OF DATA HANDLING CONFIGURATION FOR ONBOARD OPERATING SYSTEM DEFINITION, PHASE 2/3 Final Report
Paris, France ESA Dec. 1985 223 p
(Contract ESA-4710/81-NL-PP(SC))
(Matra-RF/139/1096; ESA-CR(P)-2223; DM55/JC/JP/341.83;
ETN-86-98102) Avail: NTIS HC A10/MF A01

Intelligent and decentralized spacecraft onboard data handling (OBDH) systems were studied. The definition of the OBDH system was enlarged to support the onboard function, especially for compliance with packet telemetry and telecommand; coordination between CTU and decentralized ITU; support of an extented OBDH protocol; and automatic reconfiguration and restart after failure. A breadboard which implements these functions was realized. The coherence of the OBDH concept, including fault tolerance features, is verified by tests. ESA

N87-14868# National Aerospace Lab., Amsterdam (Netherlands). Hoofdafdeling Informatica/Ruimtevaart.
CADISS: AN ONBOARD SYSTEM FOR COMPRESSION AND DECOMPRESSION OF IMAGERY SENSOR SIGNALS
A. Monkel and H. F. A. Roefs 2 May 1985 13 p In DUTCH; ENGLISH summary Submitted for publication Sponsored by Nederlandse Vereniging voor Ruimtevaart
(NLR-MP-85045-U; B8669793; ETN-86-98658) Avail: NTIS HC A02/MF A01

The system CADISS, designed for compression and decompression of imagery sensor signals onboard spacecraft is described. It is a (micro) programmable, multiprocessor system with low power consumption. It allows an efficient use of onboard mass memory and of satellite/ground telemetry links. The system can process several types of sensor signals such as mono and multispectral data (visible light, IR), multiframe (television), etc. ESA

N87-14869# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-K.
BACON-52 SINGLE BOARD CONTROLLER Thesis - Technische Hogeschool, Amsterdam, Netherlands
Jeroen deWaard 1986 49 p In DUTCH
(DIGEL-68; ETN-86-98723) Avail: NTIS HC A03/MF A01

A single board basic computer was designed and built based on the Intel 8052 microprocesor. The specifications of microcontroller, memories, input/output modules, and power supply are given. The format of the computer board is smaller than a eurocard, allowing it to be mounted piggy-back on a eurocard which itself can then be used as an experimentation space. The configuration of microcontroller, external memories, and input/output systems are described. The design and the use of the Bacon-52 are explained. ESA

N87-14870# Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (West Germany).
UNIVERSAL MICROCOMPUTER FOR THE CONTROL OF ELECTRONIC EQUIPMENT [UNIVERSELLER MIKROCOMPUTER ZUR STEUERUNG VON ELEKTRONIKEN]
M. Fradj and M. Hartung Aug. 1986 27 p In GERMAN
(GSI-86-12; ISSN-0171-4546; ETN-86-98742) Avail: NTIS HC A03/MF A01

The SD microcomputer was developed to provide beam diagnosis electronics with local intelligence. The standard equipment and the extensions of the microcomputer are described. The monitor program and subprograms (library) for the SD are explained. The floppy-disk software is presented. The different circuits of the microcomputer are shown. ESA

N87-14871# Grenoble-1 Univ. (France). Lab. Circuits et Systemes.

HSURF: AN EASY-TO-TEST MICROPROCESSOR FOR HIGH RELIABILITY APPLICATIONS Ph.D. Thesis [HSURF: UN MICROPROCESSEUR FACILEMENT TESTABLE POUR DES APPLICATIONS A HAUTE SURETE DE FONCTIONNEMENT]
Christian Jay 1986 281 p In FRENCH
(ETN-87-98586) Avail: NTIS HC A13/MF A01

A circuit design characterized by low error probability and built in test facilities is presented. Observability and controllability are emphasized. Choices made to integrate in the microprocessor architecture the on line and off line test procedures are described. The circuit design, implemented in C-M0S technology, requires a 10% to 15% increase of the silicon surface to include the additional devices. ESA

N87-14250# National Aerospace Lab., Tokyo (Japan).
TECHNIQUES TO ACHIEVE HIGH-SPEED COMPUTATIONS IN SUPERCOMPUTERS
Tadashi Watanabe *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 20-25 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14251# National Aerospace Lab., Tokyo (Japan).
VP SERIES HARDWARE
Keiichiro Uchida and Kazushi Sakamoto *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 27-32 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14253# National Aerospace Lab., Tokyo (Japan).
DATABASE ORIENTED UNIX OPERATING ENVIRONMENT AND ITS APPLICATION
Masayuki Hatakeyama *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 43-50 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

N87-14872*# Ohio State Univ., Columbus. ElectroScience Lab.
ALTERNATIVE MATHEMATICAL PROGRAMMING FORMULATIONS FOR FSS SYNTHESIS
Charles H. Reilly, Clark A. Mount-Campbell, David J. A. Gonsalvez, and Curt A. Levis Oct. 1986 35 p
(Grant NAG3-159)
(NASA-CR-180030; NAS 1.26:180030; TR-716548-6) Avail: NTIS HC A03/MF A01 CSCL 09B

A variety of mathematical programming models and two solution strategies are suggested for the problem of allocating orbital positions to (synthesizing) satellites in the Fixed Satellite Service. Mixed integer programming and almost linear programming formulations are presented in detail for each of two objectives: (1) positioning satellites as closely as possible to specified desired locations, and (2) minimizing the total length of the geostationary arc allocated to the satellites whose positions are to be determined. Computational results for mixed integer and almost linear programming models, with the objective of positioning satellites as closely as possible to their desired locations, are reported for three six-administration test problems and a thirteen-administration test problem. Author

N87-14873# IIT Research Inst., Lanham, Md.
ADA (TRADE NAME) BIBLIOGRAPHY, VOLUME 3 Report, May 1984 - Feb. 1986
Feb. 1986 258 p
(Contract MDA903-83-C-0306)
(AD-A169589; AD-E500769) Avail: NTIS HC A12/MF A01 CSCL 09/2

Citations for documents pertaining to the history, development, progress and use of Ada are listed. Included are comprehensive author and subject indices providing a cross reference to the appropriate document citation. The citations represent all documents added to the Ada Bibliographic Database since the publication of Volume II in May 1984. The Ada Joint Program Office (AJPO) manages DoDs effort to provide life-cycle support for Ada, DoDs common high-order language for computer systems, by: (1) coordinating the development and introduction of Ada, Ada Program Support Environments (APSE) and policies and methodologies regarding their use; (2) ensuring the maintenance of the language as a consistent standard; (3) providing education and training in the use of Ada for DoD and other Government agency personnel; and (4) encouraging the use of Ada by the software development community. The Ada Information Clearinghouse (AdaIC) is a function of the AJPO which coordinates the collection integration and dissemination of information on all aspects of Ada, and associated aspects of DoDs Software Initiative. As part of this effort, the AdaIC has prepared this third volume of the Ada Bibliography GRA

N87-14874# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
IMPROVED SIGNAL DELAY BOUNDS FOR RC TREE NETWORKS
David Standley and John L. Wyatt, Jr. May 1986 35 p
(Contract N00014-80-C-0622; Grant NSF ECS-82-10941)
(AD-A169625; VLSI-MEMO-86-317) Avail: NTIS HC A03/MF A01 CSCL 09/1

Upper and lower bounds on the step response of RC tree networks used to model device interconnections in MOS integrated circuits have been derived. These bounds are computationally efficient and hence suited for use in computer aided design programs for timing analysis. The main result of this paper, Theorem 1, allows us to replace the time constant T sub p in the original bounds by a new one T sub pi less than or = T sub p, thereby tightening the original bounds. GRA

N87-14875# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
TIGHT BOUNDS FOR MINIMAX GRID MATCHING WITH APPLICATIONS TO THE AVERAGE CASE ANALYSIS OF ALGORITHMS
Tom Leighton and Peter Shor Jun. 1986 29 p
(Contract N00014-80-C-0622; Grant AF-AFOSR-0326-82)
(AD-A169627; VLSI-MEMO-86-320) Avail: NTIS HC A03/MF A01 CSCL 12/2

The minimax grid matching problem is a fundamental combinatorial problem associated with the average case analysis of algorithms. The problem has arisen in a number of interesting and seemingly unrelated areas, including wafer-scale integration of systolic arrays, two-dimensional discrepancy problems, and testing pseudorandom number generators. However, the minimax grid matching problem is best known for its application to the maximum up-right matching problem, which was originally defined in association with algorithms for 2-dimensional bin packing. More recently, the up-right matching problem has arisen in the average case analysis of on-line algorithms for 1-dimensional bin packing and dynamic allocation. In this paper, the authors solve both the minimax grid matching problem and the maximum up-right matching problem. As a direct result, they obtain tight upper bounds on the average case behavior of the best algorithms known for 2-dimensional bin packing, 1-dimensional on-line packing and on-line dynamic allocation. The results also solve a long-open question in mathematical statistics. GRA

N87-14876# Washington Univ., Seattle. Dept. of Computer Science.
MOS CIRCUIT MODELS IN NETWORK C

William Beckett Jul. 1986 18 p
(Contracts MDA903-85-K-0072; ARPA Order 4563)
(AD-A169951; TR-86-07-02) Avail: NTIS HC A02/MF A01 CSCL 09/5

Network C is a programming language designed for constructing simulation models of VLSI circuits and systems. The language, which is a superset of C, supports a range of modeling capabilities including approximate solution of Kirchoff equations at the circuit level and discrete event functional simulation at the system level. When used to model a MOS circuit, the system first decomposes the circuit into a set of independent stages. The values of nodes, represented by piece-wise linear functions, are communicated between stages using discrete event scheduling. The determination of these piece-wise linear functions is based on continuous time calculations. The result of this hybrid approach is a fast simulation capability which maintains enough accuracy to capture both the digital and analog aspects of a circuit's behavior. Author (GRA)

N87-14877# Washington Univ., Seattle. Dept. of Computer Science.
COORDINATE FREE LAP
William Beckett Jul. 1986 16 p
(Contracts MDA903-85-K-0072; ARPA Order 4563)
(AD-A169982; Rept-86-07-01) Avail: NTIS HC A02/MF A01 CSCL 09/2

Coordinate Free LAP (CFL) is a library of subroutines written in C intended to facilitate the construction of VLSI circuit layouts. The operators of CFL generate new cells by forming combinations of existing cells using only relative positioning, that is without reference to a system of coordinates. CFL is able to assemble sets of large cells very quickly because its positioning and routing operations work from descriptions of the boundaries of cells and, therefore, avoid direct references to the geometry within cells.
Author (GRA)

N87-14878# University of Southern California, Los Angeles. Dept. of Computer Science.
METAPROGRAMMING: A NEW METHODOLOGY FOR THE CONSTRUCTION OF QUALITY SOFTWARE Final Report, 15 Jun. 1981 - 14 Sep. 1984
Lawrence Flon, Lee Cooprider, Ellis Horowitz, Anne M. Curran, and Thierry Paradan 30 Jan. 1986 13 p
(Grant AF-AFOSR-0199-81)
(AD-A170032; Rept-53-4510-1741; AFOSR-86-0419TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

There were three major contributions that came out of this research. The first was the development of a program development environment that permits software to be reused. The second was the development of techniques for the design and specification of concurrent programs. The third was a new method for writing programs that involves pictures. For each of these conditions a student Ph.D. thesis was produced, in particular Dr. Anne Curran worked on the first problem, Dr. Thierry Paradan worked on the second problem and Dr. Georg Raeder worked on the last problem. Since each of their contributions are radically different, this summary report is broken into three categories, each based upon their work. GRA

N87-14879# Applied Research Associates, Inc., Albuquerque, N. Mex.
COMPUTATIONAL ASPECTS OF THE ARA THREE INVARIANT CONSTITUTIVE MODEL Final Report, 1 Aug. 1984 - 31 Jul. 1985
William C. Dass and Douglas H. Merkle 29 May 1986 134 p
(Contract F49620-84-C-0066)
(AD-A170072; Rept-5934; AFOSR-86-0463TR) Avail: NTIS HC A07/MF A01 CSCL 08/13

The three invariant elastoplastic constitutive model has been implemented for use in finite difference blast and shock calculations. The model employs two yield surfaces with an independent plastic potential to control shear induced dilatancy. The model is conceptually similar to Lade's cohesionless soil model. Several improvements in the original ARA model have been incorporated during the course of implementation including tensile strength, expansive strain tracking during tensile failure, optional elimination of work softening, and a high pressure-temperature equation of state. Strain subcycling has been used to prevent violation of the consistency condition. Results are given for planar, spherical, and cylindrical one dimensional wave propagation, and are compared with results using several other currently available constitutive models. Two dimensional DIHEST calculation results are also shown. These calculations employed a newly developed interface between the Soil Element Model (SEM) subroutines and STEALTH 2D. This approach allows the SEM to act as a central bank of material models for potentially any number of continuum codes. Overall, the new constitutive model is physically realistic, somewhat expensive to run, and promising for future application. GRA

N87-14880# Naval Postgraduate School, Monterey, Calif.
NON-ROMAN FONT GENERATION VIA INTERACTIVE COMPUTER GRAPHICS
James C. Artero and Michael J. Zyda Jul. 1986 108 p
(AD-A170614; NPS52-86-018) Avail: NTIS HC A06/MF A01 CSCL 09/2

The authors present in this study an examination of the characteristics of computer symbol manipulation systems, including the conventions governing conversion of input symbols to internal code and back to output symbols. Methods to achieve flexibility in the manipulation of large, non-standard, and non-Roman-character symbol sets are discussed, primarily by examination of word processing systems designed to operate on non-Roman fonts. The intent of this discussion is to highlight the desirability of moving toward a computer design approach that incorporates generalized symbol management capabilities. Leading-edge computer graphics workstations are then evaluated or their potential to host advanced font management systems resulting from this design approach. Finally, the BUILDFONT Font Creation and Editing System, a software utility implemented on the IRIS-2400 series Graphics Workstation, is presented as a tool to assist researchers to develop generalizes symbol management applications. GRA

N87-14881# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ENHANCED SIMULATION OUTPUT THROUGH THE USE OF SPREADSHEET SOFTWARE M.S. Thesis
John P. Dieltz 1986 95 p
(AD-A170671; AFIT/CI/NR-86-91T) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper describes the development of a technique to display microcomputer simulation output data graphically, using spreadsheet software. The simulation data was generated by GPSS/PC simulation software and displayed using Lotus 1-2-3 spreadsheet software. Snapshots of data were taken at regular intervals during the simulation. The simulation output data files were then translated into Lotus 1-2-3 worksheet files by use of the Data Interchange Format (DIF). Once translated into the worksheet format the snapshots of data were combined onto a single worksheet which contained macros to generate the graphs. GRA

N87-14882# Environmental Research Inst. of Michigan, Ann Arbor.
REDUCED TOLERANCE IMAGING I Technical Report, 15 Oct. 1984 - 14 Oct. 1985
James R. Fienup, Jack N. Cederquist, Thomas R. Crimmins, Richard G. Paxman, and David L. Neuhoff Jul. 1986 193 p
(Contracts F33615-83-C-1046; DARPA Order 5205)
(AD-A170932; ERIM-167400-83-T) Avail: NTIS HC A09/MF A01 CSCL 20/6

The reduced tolerance imaging concept is to use imaging system hardware of reduced complexity to make phase-error-degraded measurements (or to lose phase information altogether) and then reconstruct diffraction-limited imagery in a post-detection processing stage using a phase retrieval algorithm. In the first year of a two-year effort several advances were made toward this end. An estimation theoretic (Cramer-Rao) lower bound on the error of estimating a coherent image for far-field (Fourier) intensity (squared modulus) measurements was derived for the case of Gaussian detector noise. Uniqueness of reconstruction from Fourier

modulus assuming a priori known support was proven for a particular class of objects -- sampled objects whose support (the area outside of which it is zero) has a convey hull with no parallel sides. A closed-form recursive reconstruction algorithm was developed for reconstructing such objects via their autocorrelation functions. Simulations showed the closed-form solution to be sensitive to noise compared with iterative Fourier transform algorithms. GRA

N87-14883# Maryland Univ., College Park. Center for Automation Research.
CAMERA ROTATION INVARIANCE OF IMAGE CHARACTERISTICS
Ken-Ichi Kanatani May 1986 47 p
(Contracts DAAK70-83-K-0018; DARPA Order 3206)
(AD-A171615; CAR-TR-202; CS-TR-1663) Avail: NTIS HC A03/MF A01 CSCL 06/4

The image transformation due to camera rotation relative to a stationary scene is analyzed, and the associated transformation rules of features given by weighted averaging of the image are derived by considering infinitesimal generators on the basis of group representation theory. Three dimensional vectors and tensors are reduced to two dimensional invariants on the image plane from the viewpoint of projective geometry. Three dimensional invariants and camera rotation reconstruction are also discussed. The result is applied to the shape recognition problem when camera rotation is involved. GRA

N87-14884# Naval Postgraduate School, Monterey, Calif.
SURFACE RECONSTRUCTION FROM PLANAR CONTOURS
Allan R. Jones, Patrick G. Hogan, and Michael J. Zyda Jul. 1986 72 p
(AD-A171617; NPS52-86-019) Avail: NTIS HC A04/MF A01 CSCL 09/2

Many applications of computer graphics involve the display of a three-dimensional solid reconstructed from a sequence of two dimensional planar contours. Surface construction algorithms accomplish this by mapping individual pairs of contours, forming triangular surface patches that approximate the original three dimensional solid. An expanded algorithm is presented which not only handles the mappings of multiple contours per plane and partial contour mappings, but also allows human interaction. A discussion is included of the algorithm's limitations and proposed solutions. GRA

N87-14885# Stanford Univ., Calif. Dept. of Computer Science.
THE COMPLEXITY OF PARALLEL ALGORITHMS
Richard Anderson Nov. 1985 72 p
(Contract N00014-85-C-0731; Grant NSF DCR-83-51757)
(AD-A172445; STAN-CS-86-1092) Avail: NTIS HC A04/MF A01 CSCL 09/2

This thesis addresses a number of theoretical issues in parallel computation. There are many open questions relating to what can be done with parallel computers and what are the most effective techniques to use to develop parallel algorithms. The author examines various problems in hope of gaining insight to the general questions. One topic that is investigated is the relationship between sequential and parallel algorithms. Introduced is the concept of a P-complete algorithm to capture what it means for an algorithm to be inherently sequential. It is shown that a number of sequential greedy algorithms are P-complete, including the greedy algorithm for finding a path in a graph. However, a problem is not necessarily difficult if an algorithm to solve it is P-complete. In some cases, the natural sequential algorithm is P-complete but a different technique gives a fast parallel algorithm. This shows that it is necessary to use different techniques for parallel computation than are used for sequential computation. Fast parallel algorithms for a number of simple graph theory problems are given. The algorithms illustrate a number of different techniques that are useful for parallel algorithms. The final topic that we address is parallel approximation of P-complete problems. GRA

N87-14886# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USER'S INTRODUCTORY GUIDE (HM-256)
J. Patterson and E. Jennings Mar. 1986 85 p
(Contract DE-FG03-85ER-25009)
(DE86-013002; DOE/ER-25009/T2) Avail: NTIS HC A05/MF A01

This document is designed for a new Concurrent Processor user (some programming experience is assumed). It is intended to give sufficient information to write and execute sample programs. An overview of the design of the concurrent computer from a software point of view is given. Types of problems suitable for a concurrent environment as well as features of the computer which assist in programming are briefly discussed. Other topics discussed are: gaining access to a computer, introductions to the UNIX and VAS/VMS operating systems, a quick introduction to the C programming language, the operating system used on the Mark II Concurrent Processor called the Crystalling Operating System (the most commonly used commands are explained along with examples), structuring programs, and information on the Simulator. Appendices contain instructions for compiling, linking, and running on each of the devices currently available. DOE

N87-14887# Lawrence Livermore National Lab., Calif. Computer Systems Research Group.
MORE OPERATING SYSTEM: A MESSAGE ORIENTED RESOURCE ENVIRONMENT
B. Cabral and M. Poggio 15 Jul. 1986 201 p
(Contract W-7405-eng-48)
(DE86-013932; UCID-20828) Avail: NTIS HC A10/MF A01

The operating system, MORE (Message Oriented Resource Environment), is designed for a software engineering environment built on the VAXstation II micro-computer. The MORE operating system is based on the message passing model. The hardware configuration of the VAXstation II is described, including a thorough discussion of the hardware operating system support features of the VAX architecture. The software engineering environment that MORE will provide for the user is discussed. The operating system as the application programmer will see it is presented in the form of a system services manual for MORE. The concept of a server in MORE and the objects or resources manipulated by the servers are included. The high level implementation and organization of MORE, the device managers and drivers, and the kernel of MORE are detailed. DOE

N87-14888# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
UNIGRAPH: A PROGRAM SYSTEM FOR GRAPHIC OUTPUT, DOCUMENTATION AND MANAGEMENT OF ARBITRARY, TWO-DIMENSIONAL VOLUMES OF DATA
M. Bauer and P. Groll May 1986 115 p In GERMAN; ENGLISH summary
(KfK-4081; ISSN-0303-4003; ETN-86-98191) Avail: NTIS HC A06/MF A01

The interactive program system UNIGRAPH is presented. This program system allows in a comfortable way the processing, management, and documentation of arbitrary, two-dimensional data and measuring value series, their graphic output on display units and plotters. A high user friendliness was obtained by using service routines of the Interactive System Productivity Facility. The graphic editing and output are based on the program system TRACEGS7 which contains the graphic basic software system GS. ESA

N87-14889# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Sci./Algorithms and Architecture.
THE CLEANING PERSON ALGORITHM
Tim Budd Feb. 1986 15 p
(CWI-CS-R8610; B8671566; ETN-86-98668) Avail: NTIS HC A02/MF A01

An algorithm that permits values to migrate easily between primary and secondary memory (or disk), permitting the B system

to act as if the amount of memory was essentially limitless is described. The algorithm can be viewed as a trio of interacting processes. The first process represents the B system, a more or less conventional interpretive system, which is allocating and using memory. Thus the B system sits on top of the memory manager, which controls the allocation of memory and tries to discover when memory is no longer being used. In parallel with these a third process, the cleaning person, attempts to move nodes from primary memory (RAM) to secondary storage (disk), thereby freeing nodes for reclamation by the memory manager. ESA

N87-14890# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Sci./Algorithms and Architecture.
THE POWER OF THE QUEUE
Ming Li, Luc Longpre, and Paul M. B. Vitanyi Apr. 1986 20 p Presented at Structure in Complexity Theory Conference, Berkeley, Ca., 2-5 Jun. 1985 Submitted for publication
(Contracts N00014-82-K-0154; DAAG29-84-K-0058; DAAG29-79-C-0155)
(CWI-CS-R8612; B8671568; ETN-86-98670) Avail: NTIS HC A02/MF A01

Queues are compared to stacks and tapes. Offline machines with a one-way input, deterministic and nondeterministic are considered. The techniques rely on algorithmic information theory (Kolmogorov complexity). The jamming lemma is used. It is shown that deterministically simulating a queue by a tape takes quadratic time (infinitely often). A lower bound for nondeterministically simulating a stack by a queue is obtained. Lower and upper bounds for simulating k queues by 2 queues or 2 queues by 1 queue are obtained. ESA

N87-14891# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science/Software Technology.
KNOWLEDGE REPRESENTATION AND INFERENCE IN RULE-BASED SYSTEMS
P. J. F. Lucas Apr. 1986 20 p
(CWI-CS-R8613; B8671569; ETN-86-98671) Avail: NTIS HC A02/MF A01

Approaches to representing and applying human knowledge in expert systems, in particular in rule-based systems, are reviewed. Equivalent methods of representation are introduced. Low-level operations and inference procedures applied in extracting useful knowledge from a knowledge base are emphasized. The design and the implementation of the DELFI-2 system, particularly influenced by concepts from logic programming, are mentioned. ESA

N87-14892# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Sci./Algorithms and Architecture.
A GENERAL OBJECT-CENTERED DATABASE LANGUAGE (GODEL): A PRELIMINARY DEFINITION
Martin L. Kersten and Frans H. Schippers Apr. 1986 24 p
(CWI-CS-R8615; B8671571; ETN-86-98673) Avail: NTIS HC A02/MF A01

The programming language GODEL, for the construction of knowledge based applications is described. It uses object-centered, rule-oriented, and procedural programming paradigms. These paradigms are used in an unconventinal way, thereby simplifying the maintenance of complex relationships among (static) objects and modeling dynamic behavior through actor-like objects, called guardians. An informal semantic definition is given. The language definition assumes a teletype-like user interface, which simplifies the language specification and its implementation. A functional prototype was implemented in C-PROLOG under UNIX BSD4.2. ESA

N87-14893# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science/Software Technology.
PROLOG: AN EXPERT SYSTEM BUILDING TOOL
L. C. vanderGaag Apr. 1986 17 p
(CWI-CS-R8616; B8671572; ETN-86-98674) Avail: NTIS HC A02/MF A01

The suitability of PROLOG as an expert system building tool is demonstrated. A small expert system shell is discussed, and compared to the DELFI-2 system. Advantages of PROLOG include the separation of knowledge and inference as a principle in the development of expert system shells, achieved naturally as a consequence of the principles of logic programming. Production rules are represented as Horn clauses in a straightforward manner. Part of the inference engine is already provided for in the PROLOG interpreter. The use of a PROLOG expert system in a real-life environment, however, has a considerable drawback: its inefficiency compared with, for instance, Pascal. Nonetheless, a PROLOG rule based expert system can be developed in a short time, making PROLOG a suitable language for the rapid development of propotype systems. ESA

N87-14894# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science/Software Technology.
MODULE ALGEBRA
J. A. Bergstra (Utrecht State Univ. (Netherlands).), J. Heering, and P. Klint May 1986 38 p Submitted for publication Sponsored by European Economic Commission
(CWI-CS-R8617; B8671573; ETN-86-98675) Avail: NTIS HC A03/MF A01

An axiomatic algebraic calculus of modules based on the operators combination/union, export, renaming, and taking the visible signature is given. Four different models of module algebra are compared. ESA

N87-14895# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science/Software Technology.
ALGEBRAIC SPECIFICATIONS OF COMPUTABLE AND SEMI-COMPUTABLE DATA TYPES
J. A. Bergstra (Amsterdam Univ. (Netherlands).) and J. V. Tuckder (Leeds Univ. (England).) May 1986 63 p Revised version of MC/IW115 Submitted for publication Sponsored by European Economics Commission
(CWI-CS-R8619; MC/IW115; B8671574; ETN-86-98676) Avail: NTIS HC A04/MF A01

Specification mechanisms based on initial algebra semantics are reviewed. Specifications with hidden functions and hidden sorts; computable and semicomputable algebras; limitations of specifications without hidden mechanisms; and adequacy and completeness theorems for specifications with hidden mechanisms are considered. ESA

N87-14896# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
NUMVEC FORTRAN LIBRARY MANUAL. CHAPTER: SIMULTANEOUS LINEAR EQUATIONS
W. Hoffmann (Amsterdam Univ. (Netherlands).) and W. M. Lionen May 1986 36 p
(CWI-NM-R8614; B8671261; ETN-86-98687) Avail: NTIS HC A03/MF A01

A set of NUMVEC FORTRAN library routines, dealing with the unique solution of real linear systems is described. Only highly optimized nonportable implementations for the CYBER 200 series computer systems are included in the library. ESA

N87-14897# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
EINDHOVEN SCHEMATIC EDITOR (ESCHER) REFERENCE MANUAL
A. Lodder, M. T. vanStiphout, and J. T. J. vanEijndhoven Feb. 1986 81 p Sponsored by European Economic Commission Microelectronics Program 3744/81, and the Ministry of Economic Affairs, Netherlands
(EUT-86-E-157; ISBN-90-6144-157-9; ISSN-0167-9708; ETN-86-98713) Avail: NTIS HC A05/MF A01

A user guide for a schematics editor program, for defining electric circuits by interactively drawing a hierarchically structured network is presented. The output is in accordance with the ICD network standard, interfacing with several simulation programs and layout generation tools. To cope with the hierarchy, for each module (template) a contents is defined, as well as a representation. The contents section consists of instances of other modules, connections, and expressions for actual parameters of the instances. The representation consists of a symbol, terminals, and a formal parameter declaration. The schematic editor can handle busses in a very flexible way, handling mixed analog and digital circuits, and features a validity check and a multilevel UNDO command. The program is intended for a UNIX/C environment, and has LINT approval for portability. ESA

N87-14898# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EVALUATION OF METHODS FOR COORDINATION OF SOFTWARE TECHNOLOGICAL TASKS USING EXAMPLES OF THE SPACELAB PROGRAM AND AIR SURVEILLANCE PROGRAM. PART 3: EXPERIENCE REPORT FOR A SOFTWARE PROJECT FOR AIR SURVEILLANCE Final Report, Jun. 1983
Wolfgang Ehler and Lino Fornasiero Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 212 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-86-005; ISSN-0170-9011; ETN-86-98757) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38

Methods and the experience gained from the development of applications software for an air surveillance system are summarized. The project management functions and the software production steps in the project are discussed. ESA

N87-14899# Royal Air Force Coll., Cranwell (England). Dept. of Electrical Engineering.
PRODUCTION OF A DIGITAL COMPUTER SIMULATION OF THE TRAJECTORY OF A THRUST VECTOR CONTROLLED AIR TO AIR MISSILE IN THREE DIMENSIONS M.S. Thesis
K. M. Forrest 1985 185 p Prepared in cooperation with Loughborough University of Technology, England
(ETN-86-98359) Avail: NTIS HC A09/MF A01

Control methods are discussed, and their applicability to agile air to air missiles is considered. Proportional navigation and acceleration vectored navigation laws are also discussed for the two dimensional engagement, and a form of each law suitable for simulation is obtained. Guidance laws for three dimensional engagement are developed using vector algebra. The high incidence aerodynamics associated with agile missiles are discussed, and the effects of these phenomena on the dynamics of the vehicle are considered. ESA

N87-14900# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
EXAMINATION RESULTS IN CONTEXT MBA [EXAMENRESULTATEN IN CONTEXT MBA]
A. C. P. vanMeer May 1986 18 p In DUTCH; ENGLISH summary
(EUT-85-E-150; ISBN-90-6144-150-1; ISSN-0167-9708; ETN-86-98706) Avail: NTIS HC A02/MF A01

Examination results were processed by a computer program Context MBA. All information about the examination is supplied to the program, and after correction procedures, the solutions are added. This can be done by adjusting the spreadsheet on a specially arranged format. The results and the final mark also appear in their format on the screen or in a special format on the printer. ESA

N87-14901# IKO Software Service G.m.b.H., Stuttgart (West Germany). Product Center.
EVALUATION OF FUNCTIONS AND INTERFACES FOR COMPUTER AIDED ENGINEERING IN SUPPORT OF SPACE SYSTEMS DESIGN, MANAGEMENT STUDY
F. J. Fecke, R. Rothenberg, C. Arnold, J. Dubois, R. Valent, H. Charlier, R. Reefman, and R. vanSchalkwijk Paris, France ESA 16 Jul. 1985 386 p
(Contract ESTEC-5666/83-NL-PP(SC))
(ESA-CR(P)-2222; ETN-87-98648) Avail: NTIS HC A17/MF A01

The state of the art of computer aided engineering (CAE) in the European space industry was reviewed. User requirements; data base management systems; configuration control; human interfaces; ESABASE; and standards were examined. A policy for CAE in ESA is proposed. ESA

N87-14902# Research Inst. of National Defence, Linkoeping (Sweden).
ON HIERARCHICAL EDGE MATCHING IN DIGITAL IMAGES USING DISTANCE TRANSFORMATIONS Ph.D. Thesis
Gunilla Borgefors Apr. 1986 114 p
(FOA-B-30094-E1; ISSN-0281-0263; TRITA-NA-8602; ETN-87-98336) Avail: NTIS HC A06/MF A01

A digital image matching algorithm called hierarchical chamfer matching was developed. It matches low-level image features, such as edges. It uses a hierarchical structure. The algorithm gives correct results using a reasonable amount of computational resources in all tested applications. Distance transformations that use iterated local operations are developed and analyzed. Two excellent integer distance transformations are discovered. ESA

N87-14903# Grenoble-1 Univ., Saint Martin d'Heres (France). Lab. d'Informatique Fondamentale et d'Intelligence.
PROGRAM SYNTHESIS = PROOF METHOD + KNOWLEDGE. EXAMPLE OF RECURSION FUNCTION SYNTHESIS
Paul Jacquet and Marie-Laure Potet Apr. 1986 13 p Presented at the 7th European Conference on Artificial Intelligence, Brighton, England, 21-25 Jul. 1986
(RR-605-IMAG-48-LIFIA-I; ETN-87-98572) Avail: NTIS HC A02/MF A01

To master the inherent complexity of deductive program synthesis, an approach in which the proof of the initial specification is split into two parts is proposed. One constructs a program in proving the specification, the other infers the needed theorems. The decomposition is illustrated in developing a strategy for the synthesis of recursive functions. ESA

N87-14904# Institut National Polytechnique, Grenoble (France). Lab. des Techniques de l'Informatique, des Mathematics.
PARALLEL ALGORITHMS: AUTOMATA NETWORKS, SYSTOLIC ARCHITECTURES, SIMD AND MIMD MACHINES Ph.D. Thesis [ALGORITHMIQUE PARALLELE: RESEAUX D'AUTOMATES, ARCHITECTURES SYSTOLIQUES, MACHINES SIMD ET MIMD]
Yves Robert 1986 460 p Partly in FRENCH and ENGLISH
(ETN-87-98591) Avail: NTIS HC A20/MF A01

The parallelization of Jordan methods and the diagonal parameters for the resolution of linear systems are studied by evaluating the number of arithmetical operations. For each problem two parallel designs are obtained and efficient algorithms are proposed. In most cases the optimal algorithms are synchronous. It is shown that the best parallelization of Jordan method is made by lines while for diagonal parameters it is made by columns. ESA

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N87-14905# State Univ. of New York, Stony Brook. Dept. of Computer Science.
PORTABLE OPERATING SYSTEMS FOR NETWORK COMPUTERS: DISTRIBUTED OPERATING SYSTEMS SUPPORT FOR GROUP COMMUNICATIONS Final Report, 12 Apr. 1982 - 31 Aug. 1985
Larry D. Wittie 31 Oct. 1985 37 p
(Contract DAAG29-82-K-0103)
(AD-A170113; ARO-18864.12-EL) Avail: NTIS HC A03/MF A01

CSCL 09/2

The project Portable Operating Systems for Network Computers that ran from April 1982 until August 1985 saw the creation of an entire distributed operating system (MICROS/SAM2S) for a multiple ethernet system of DEC LSI-11 and Motorola 68000 systems. The modularity, hidden type managers, abstract manager hierarchies, message-oriented drivers, and layered tasks used in the design of the SAM2S operating system allowed the easy porting of the original LSI-11 based system to Motorola 68000 processors and its extension to a plexus of four interconnected ethernets. The system was used to explore ways to support efficient communications within groups of processes scattered over many computers, especially in very large networks. This project has carefully delineated different classes of multicast communications within networks and has shown three different efficient ways to implement multicast: host, channel, and tree-based protocols. Only tree multicast is suitably efficient for networks of thousands of computers. GRA

N87-14906# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Sci./Algorithms and Architecture.

DISTRIBUTED CONTROL IN COMPUTER NETWORKS AND CROSS SECTIONS OF COLORED MULTIDIMENSIONAL BODIES

Evangelos Kranakis and Paul M. B. Vitanyi Mar. 1986 16 p Submitted for publication Sponsored in part by Amsterdam University, Netherlands

(Contracts N00014-82-K-0154; DAAG29-79-C-0115; DAAG29-84-K-0058; NSF 83-2391-A01-DCR)

(CWI-CS-R8611; B8671567; ETN-86-98669) Avail: NTIS HC A02/MF A01

Lower bounds on the average number of point-to-point transmissions between any pair of nodes in a multiprocessor network are establisned. The analysis allows for the possibility of multiple transmissions between any two nodes, and also for the possibility of multiple queries (as opposed to the two, i.e., post and a single query considered before). Applications of the results include lower bounds on the number of messages for distributed s-matching, that is, matching a group of s processes, and distributed s-mutual exclusion, that is, s-1 processes may enter a critical section simultaneously, but s processes may not, for s > or = 2. The idea of the proof of the combinatorial result needed for this analysis is extended to obtain a lower bound on the average number of colors occurring in random cross-sections of colored, multidimensional bodies in terms of the total (multidimensional) volume of each color in the whole body. ESA

N87-14907# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Computer Science.

ASPECTS OF THE AMSTERDAM MULTIPROCESSOR PROLOG SYSTEM [ASPECTEN VAN HET AMSTERDAMS MULTIPROCESSOR PROLOG SYSTEEM]

L. O. Hertzberger, W. G. P. Mooy, and W. E. vanWaning Mar. 1986 8 p In DUTCH Sponsored by Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek

(FVI-86-09; B8669246; ETN-86-98666) Avail: NTIS HC A02/MF A01

The status of development of a parallel PROLOG machine is described. The logical programming language PROLOG is potentially suitable for multiprocessor computer systems. The implementation of the parallel PROLOG system is based on three existing subsystems. The evaluation model for this system, called parallel head matching, is an alternative for or-parallellism and has attractive properties, such as minimal assumptions with respect to the parallellism inferent to the hardware and managability of processing. The communication model is simple and can be easily implemented with the distributed real time operating system FADOS. ESA

N87-14908# Grenoble-1 Univ., Saint Martin d'Heres (France). Lab. des Techniques de l'Information, des Mathematics.

PERFORMANCE OF A PIPELINE ARRAY OF AUTOMATA WITH PERIODIC CYCLE-TIME

E. Goles, I. Sakho, and M. Tchuente May 1986 17 p Sponsored in part by Fundo Nacional de Ciencias de Chile

(RR-607-IMAG-I; ETN-87-98574) Avail: NTIS HC A02/MF A01

A pipeline array of processors where local communications are based on a producer-consumer mechanism is considered. It is assumed that any processor contains a buffer of size 1, and that the cycle-time of any processor is a periodic sequence of period s(j), s(j+l), ..., s(n), ..., s(j-l), where s is a fixed permutation of 1, 2, ..., n, and j may vary from one processor to another. Upper and lower bounds for the performance of the system are given. ESA

N87-14909# Grenoble-1 Univ. (France).

SYSTOLIC NETWORKS FOR THE SOLUTION OF LINEAR PROBLEMS Ph.D. Thesis [RESEAUX SYSTOLIQUES POUR LA RESOLUTION DE PROBLEMES LINEAIRES]

Lamine Melkemi 1986 103 p Partly in FRENCH and ENGLISH (ETN-87-98589) Avail: NTIS HC A06/MF A01

The performance of systolic algorithms is studied. The analysis is based on the combination of three criteria: computation time, number of treatment units, and number of memory access. Matrix products in the rectangular network class are analyzed. Systolic networks to detect the squares of words are proposed. A one dimensional network is shown to recognize the words without squares. The usefulness of cost optimization procedures in systolic networks is emphasized. ESA

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N87-14910*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ADAPTIVE INVERSE CONTROL FOR ROTORCRAFT VIBRATION REDUCTION Ph.D. Thesis

Stephen A. Jacklin Oct. 1985 192 p

(NASA-TM-86829; A-85396; NAS 1.15:86829) Avail: NTIS HC A09/MF A01 CSCL 62O

The Least Mean Square (LMS) algorithm is extended to solve the multiple-input, multiple-output problem of alleviating N/Rev helicopter fuselage vibration by means of adaptive inverse control. A frequency domain locally linear model is used to represent the transfer matrix relating the high harmonic pitch control inputs to the harmonic vibration outputs to be controlled. By using the inverse matrix as the controller gain matrix, an adaptive inverse regulator is formed to alleviate the N/Rev vibration. The stability and rate of convergence properties of the extended LMS algorithm are discussed. It is shown that the stability ranges for the elements of the stability gain matrix are directly related to the eigenvalues of the vibration signal information matrix for the learning phase, but not for the control phase. The overall conclusion is that the LMS adaptive inverse control method can form a robust vibration control system, but will require some tuning of the input sensor gains, the stability gain matrix, and the amount of control relaxation to be used. The learning curve of the controller during the learning phase is shown to be quantitatively close to that predicted by averaging the learning curves of the normal modes. It is shown that the best selections of the stability gain matrix elements and the amount of control relaxation is basically a compromise between slow, stable convergence and fast convergence with increased possibility of unstable identification. Author

N87-14911# California Univ., Irvine. Dept.of Information and Computer Science.

CONCEPTUAL CLUSTERING USING RELATIONAL INFORMATION Interim Report, Jan. - Apr. 1986

Bernd Nordhausen 23 Jun. 1986 16 p

(Contract N00014-84-K-0345)

(AD-A170874; UCI-ICS-TR-85-15; TR-6) Avail: NTIS HC A02/MF A01 CSCL 09/4

Work in conceptual clustering has focused on creating classes from objects with a fixed set of features, such as color or size. In this paper we describe a system which uses relations between the objects being clustered as well as features of the objects to form a hierarchy tree of classes. Unlike previous conceptual clustering systems, this algorithm can define new attributes. Using relational information the system is able to find object classifications not possible with conventional conceptual clustering methods.
Author (GRA)

N87-14912# Oxford Univ. (England). Dept. of Engineering Science.
ROBUST STABILITY UNDER ADDITIVE PERTURBATIONS: AN IMPLICIT ASSUMPTION
Yung Kuan Foo and Ian Postlethwaite 1986 11 p Sponsored by United Science and Engineering Research Council
(OUEL-1622/86; ETN-86-98348) Avail: NTIS HC A02/MF A01

The algebraic robust stability result of Bhaya and Desoer (1985) is discussed. Bhaya and Desoer derived a necessary and sufficient condition for the U-stability of a multiple input/multiple output linear time invariant system under arbitrary perturbations, where U denotes an undesirable symmetric region of the complex plane, and includes at least the closed right half plane. It is shown that their result implicity assumes that the total number of poles in U of the perturbed plant is equal to the total number of poles in the nominal plant plus the total number of poles in U of the perturbation.
ESA

N87-14913# Oxford Univ. (England). Dept. of Engineering Science.
REDUCED COMPLEXITY SET-POINT FOLLOWING IN SELF-TUNING CONTROL
K. Warwick and M. Farsi 1986 9 p Sponsored by General Electric Corp.
(OUEL-1626/86; ETN-86-98350) Avail: NTIS HC A02/MF A01

An external input signal is incorporated into a self-tuning controller which, although based on a CARMA system model, employs a state-space framework for control law calculations. Steady-state set point following can then be accomplished even when only a recursive least squares parameter estimation scheme is used, despite the fact that the disturbance affecting the system may be colored.
ESA

N87-14914# Grenoble-1 Univ., Saint Martin d'Heres (France). Lab. d'Informatique Fondamentale et d'Intelligence.
LOCATION OF THE COMMUNICATION PROCESS NETWORK DESCRIBED IN FP2 ON A GRAPH STRUCTURE IN ORDER TO IMPLEMENT THE PARALLEL PROCESSING OF THAT LANGUAGE [PLACEMENT D'UN RESEAU DE PROCESSUS COMMUNICANTS DECRIT EN FP2 SUR UNE STRUCTURE DE GRILLE EN VUE D'UNE IMPLANTATION PARALLELE DE CE LANGAGE]
Annick Marty May 1986 78 p In FRENCH; ENGLISH summary
(RR-606-IMAG-49-LIFIA-I; ETN-87-98573) Avail: NTIS HC A05/MF A01

Mapping the graph of a network of communication processes onto a two dimensional grid is discussed. The aim is to represent directly the resulting graph on a cellular multiprocessor machine with that structure. The steps required are the application of an algorithm which transforms any graph into a grid structured graph by means of transparent nodes, and the transformations of any FP2 network required prior to applying this algorithm. It is shown that an FP2 network with a grid structure is attainable for any initial network.
ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N87-14915*# TRW Defense Systems Group, Houston, Tex.
ENGINEERING DESCRIPTION OF THE ASCENT/DESCENT BET PRODUCT
A. W. Seacord, II Aug. 1986 127 p
(Contract NAS9-17554)
(NASA-CR-171953; NAS 1.26:171953; TRW47467-H007-UX-00) Avail: NTIS HC A07/MF A01 CSCL 12A

The Ascent/Descent output product is produced in the OPIP routine from three files which constitute its input. One of these, OPIP.IN, contains mission specific parameters. Meteorological data, such as atmospheric wind velocities, temperatures, and density, are obtained from the second file, the Corrected Meteorological Data File (METDATA). The third file is the TRJATTDATA file which contains the time-tagged state vectors that combine trajectory information from the Best Estimate of Trajectory (BET) filter, LBRET5, and Best Estimate of Attitude (BEA) derived from IMU telemetry. Each term in the two output data files (BETDATA and the Navigation Block, or NAVBLK) are defined. The description of the BETDATA file includes an outline of the algorithm used to calculate each term. To facilitate describing the algorithms, a nomenclature is defined. The description of the nomenclature includes a definition of the coordinate systems used. The NAVBLK file contains navigation input parameters. Each term in NAVBLK is defined and its source is listed. The production of NAVBLK requires only two computational algorithms. These two algorithms, which compute the terms DELTA and RSUBO, are described. Finally, the distribution of data in the NAVBLK records is listed.
B.G.

N87-14916*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEMI-IMPLICIT AND FULLY IMPLICIT SHOCK-CAPTURING METHODS FOR HYPERBOLIC CONSERVATION LAWS WITH STIFF SOURCE TERMS
H. C Yee and Judy L. Shinn (National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.) Dec. 1986 25 p
(NASA-TM-89415; A-87044; NAS 1.15:89415) Avail: NTIS HC A02/MF A01 CSCL 72B

Some numerical aspects of finite-difference algorithms for nonlinear multidimensional hyperbolic conservation laws with stiff nonhomogenous (source) terms are discussed. If the stiffness is entirely dominated by the source term, a semi-implicit shock-capturing method is proposed provided that the Jacobian of the soruce terms possesses certain properties. The proposed semi-implicit method can be viewed as a variant of the Bussing and Murman point-implicit scheme with a more appropriate numerical dissipation for the computation of strong shock waves. However, if the stiffness is not solely dominated by the source terms, a fully implicit method would be a better choice. The situation is complicated by problems that are higher than one dimension, and the presence of stiff source terms further complicates the solution procedures for alternating direction implicit (ADI) methods. Several alternatives are discussed. The primary motivation for constructing these schemes was to address thermally and chemically nonequilibrium flows in the hypersonic regime. Due to the unique structure of the eigenvalues and eigenvectors for fluid flows of this type, the computation can be simplified, thus providing a more efficient solution procedure than one might have anticipated.
Author

N87-14917# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY CONSIDERATION ON ROBUSTNESS OF NON-LINEAR DISCRETE-TIME REGULATORS [CONSIDERACOES PRELIMINARES SOBRE A ROBUSTEZ DE REGULADORES NAO-LINEARES A TEMPO DISCRETO]
Jose Jaime daCruz and Jose Claudio Geromel Aug. 1986 99 p In PORTUGUESE; ENGLISH summary
(INPE-4015-RPE/520) Avail: NTIS HC A05/MF A01

A robustness study for nonlinear discrete-time regulators is presented in this report. Conditions for the asymptotical stability of the closed-loop system subject to perturbations in the optimal

control law are established. Two classes of perturbations, defined in the text as distortive and additive, are considered in the analysis. The Lyapunov function adopted corresponds to the optimal cost resulting from the solution of the dynamic programming equation associated with the regulator problem. The analysis of linear quadratic regulators, based on the study of properties of the algebraic Riccati equation, constitutes a significant part of the work. In this case, the existence of a conflicting nature between the robustness characteristics associated with both types of perturbations under consideration emerges as one of the most important results obtained here. This fact brings up the necessity for a compromise solution in the controller design. Author

N87-14918*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS BY FAST POISSON SOLVERS USING A LOCAL RELAXATION FACTOR. 2: TWO-STEP METHOD
Sin-Chung Chang May 1986 17 p
(NASA-TP-2530; E-2528-1; NAS 1.60:2530) Avail: NTIS HC A02/MF A01 CSCL 12A

A two-step semidirect procedure is developed to accelerate the one-step procedure described in NASA TP-2529. For a set of constant coefficient model problems, the acceleration factor increases from 1 to 2 as the one-step procedure convergence rate decreases from + infinity to 0. It is also shown numerically that the two-step procedure can substantially accelerate the convergence of the numerical solution of many partial differential equations (PDE's) with variable coefficients. Author

N87-14919# Maryland Univ., College Park. Dept. of Mathematics.
A FAST GRAPHICAL GOODNESS OF FIT TEST FOR TIME SERIES MODELS
Benjamin Kedem Aug. 1985 20 p
(Grant AF-AFOSR-0187-82)
(AD-A170094; MD-85-38-BK; TR85-32; AFOSR-86-0274TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The oscillatory appearance of stationary time series is captured very economically by only a few higher order crossings which in addition contain a great deal of the spectral content of the process. A useful approximation to the variances of higher order crossings is discussed and is applied in construction of probability limits for the hypothesized higher order crossings. From this, a graphical display of higher order crossings together with their probability limits provide a fast goodness of fit test. Examples illustrate the applicability of this device. Author (GRA)

N87-14920# Brown Univ., Providence, R. I. Center for Dynamical Systems.
LIMITING BEHAVIOR OF LINEARLY DAMPED HYPERBOLIC EQUATIONS
Jack K. Hale and Nicholas Stavrakakis Jan. 1986 43 p
(Contract DAAG-29-83-K-0029; Grants AF-AFOSR-0376-84; NSF DMS-85-07056)
(AD-A170161; LCDS-86-6; AFOSR-86-0373TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

For a linearly damped wave equation in a bounded domain in R sub n, it is shown that there is a compact attractor in H 1st power x L to the 2nd power as well as in (H to the 2nd power intersection H sub 0 to the 1st power) x H sub 0 to the 1st power. Similar results are given for the linearly damped beam equation. Author (GRA)

N87-14921# Brown Univ., Providence, R. I. Center for Dynamical Systems.
UPPER SEMICONTINUITY OF ATTRACTORS FOR APPROXIMATIONS OF SEMIGROUPS AND PARTIAL DIFFERENTIAL EQUATIONS
Jack K. Hale, Xiao-Biao Lin, and Genevieve Raugel Oct. 1985 74 p Prepared in cooperation with Michigan State Univ., East Lansing
(Contract DAAG29-83-K-0029; Grants AF-AFOSR-0376-84; NSF DMS-85-07056)
(AD-A170187; LCDS-85-29; AFOSR-86-0374TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Suppose a given evolutionary equation has a compact attractor and the evolutionary equation is approximated by a finite dimensional system. Conditions are given to ensure the approximate system, have a compact attractor which converges to the original one as the approximation is refined. Applications are given to parabolic and hyperbolic partial differential equations. GRA

N87-14922# Brown Univ., Providence, R. I. Center for Dynamical Systems.
INTERACTION OF DIFFUSION AND BOUNDARY CONDITIONS
Jack K. Hale and Carlos Rocha Jul. 1986 37 p
(Contract DAAG29-83-K-0029; Grants AF-AFOSR-0376-84; NSF DMS-85-07056)
(AD-A170217; LCDS-85-24; AFOSR-86-0372TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

For systems of reaction diffusions, the existence and behavior of the solutions on the compact attractor are discussed for large diffusion coefficients and boundary conditions which can vary from Neumann to Dirichlet conditions. GRA

N87-14923# Maryland Univ., College Park. Dept. of Computer Science.
PARALLEL MATRIX COMPUTATIONS Interim Report, Apr. 1985 - Apr. 1986
G. W. Stewart and Dianne P. OLeary 12 May 1986 12 p
(Grant AF-AFOSR-0078-82)
(AD-A170699; AFOSR-86-0548TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This project concerns the design and analysis of algorithms to be run in a processor-rich environment. The authors focus primarily on algorithms that requires no global control and that can be run on systems with only local connections among processors. They investigate the properties of these algorithms both theoretically and experimentally. The experimental work is done on the ZMOB, a working parallel computer operated by the Laboratory for Parallel Computation of the Computer Science Department at the University of Maryland. To give this work direction, they focused on two areas: dense problems from numerical linear algebra; and the iterative and direct solution of sparse linear systems. Author (GRA)

N87-14924# Arizona Univ., Tucson. Dept. of Mathematics.
MULTI-GRID CONTINUATION AND SPURIOUS SOLUTIONS FOR NONLINEAR BOUNDARY VALUE PROBLEMS Annual Report, 1 Oct. 1985 - 1 Jul. 1986
Hans Mittelmann Jul. 1986 27 p
(Grant AF-AFOSR-0315-84)
(AD-A173081; TR-90; AFOSR-86-0888TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Recently the author together with R. Bank has developed, implemented and successfully applied a continuation technique for the numerical solution of parameter-dependent nonlinear elliptic boundary value problems. The method was integrated into an existing multi-grid package based on an adaptive finite element discretization. This document presents the continuation method and proves an important theoretical result for the corrector iteration. For the Bratu problem - delta u = lambda e sub u on the square with homogeneous Dirichlet conditions, it is shown how spurious solutions may be encountered while computing relevant solutions, how the program handles those and how it allows to detect them. GRA

N87-14925# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Sci./Algorithms and Architecture.
LOWER BOUNDS FOR A CLASS OF KOSTKA NUMBERS
Jan Willem Klop and Evangelos Kranakis Apr. 1986 12 p Submitted for publication
(CWI-CS-R8614; B8671570; ETN-86-98672) Avail: NTIS HC A02/MF A01

A simple proof of a lower bound on the number of 2 m X 2 m matrices with 0,1 entries and each of whose rows and columns adds to the fixed sum m is presented. It is shown that for any fixed 0 < lambda < 1/2 the number of such matrices is asymptoticaly at least (2 m, m) m + lambda m. The inductive proof employed might also be useful in obtaining lower bounds for other types of Kostka numbers. ESA

N87-14926# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
ON THE MATHEMATICAL SYNTHESIS OF PHYSIOLOGICAL AND BEHAVIORAL MECHANISMS AND POPULATION DYNAMICS
Odo Diekmann Feb. 1986 10 p Presented at the International Symposium on Mathematical Biology, Kyoto, Japan, 10-15 Nov. 1985 Submitted for publication
(CWI-AM-R8601; B8669754; ETN-86-98678) Avail: NTIS HC A02/MF A01

A mathematical framework for the synthesis of physiological ecology and population dynamics is presented. Physiologically structured population models, first order partial functional differential equations, and dual semigroups are introduced. Dynamical systems theory is applied. ESA

N87-14927# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
NUMVEC FORTRAN LIBRARY MANUAL. CHAPTER: PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS (PDEs). ROUTINE: BACKWARD DIFFERENTIATION MULTIGRID (BDMG)
B. P. Sommeijer Mar. 1986 20 p
(CWI-NM-R8610; B8671258; ETN-86-98683) Avail: NTIS HC A02/MF A01

The NUMVEC FORTRAN library routine BDMG, which integrates in time a semidiscrete scalar parabolic partial differential equation defined over a two-dimensional rectangular region is described. The time integration is based on the second-order backward differentiation method; the resulting implicit relations are solved by employing a multigrid technique. ESA

N87-14928# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
PHASE LAG ANALYSIS OF IMPLICIT RUNGE-KUTTA METHODS
P. J. vanderHouwen and B. P. Sommeijer Apr. 1986 19 p
(CWI-NM-R8612; B8671260; ETN-86-98685) Avail: NTIS HC A02/MF A01

The phase errors introduced by implicit Runge-Kutta methods when a linear inhomogeneous test equation is integrated are analyzed. It is shown that the homogeneous phase errors dominate if long interval integrations are performed. Homogeneous dispersion relations for diagonally implicit Runge-Kutta (DIRK) methods are derived and high-order dispersive DIRK methods are constructed. The methods are applied to systems of linear differential equations with oscillating solutions, and compared with the conventional DIRK methods of Norsett and Crouzeix (1974, 1979). ESA

N87-14929# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
STABILIZATION OF THE LAX-WENDROFF METHODS AND A GENERALIZED ONE-STEP RUNGE-KUTTA METHOD FOR HYPERBOLIC INITIAL-VALUE PROBLEMS
Erik deGoede May 1986 15 p
(CWI-NM-R8613; B8671262; ETN-86-98686) Avail: NTIS HC A02/MF A01

In order to integrate hyperbolic systems, explicit and implicit time integrators are distinguished. Implicit methods allow large integration steps, but require more storage and are more difficult to implement than explicit methods. However, explicit methods are subject to a restriction on the integration step. This restriction is a drawback if the variation of the solution in time is so small that accuracy considerations would allow a larger integration step. A smoothing technique is applied to stabilize the Lax-Wendroff method and a generalized one-step Runge-Kutta method. Using this technique, the integration step is not limited by stability considerations. ESA

N87-14930# Oxford Univ. (England). Dept. of Engineering Science.
MODEL REDUCTION OF SAMPLED DATA SYSTEMS
K. Warwick 1986 17 p Sponsored by General Electric Corp.
(OUEL-1625/86; ETN-86-98349) Avail: NTIS HC A02/MF A01

Model reduction of high order sampled data systems is considered via Pade approximation, the Routh stability criterion, and power series parameter matching. It is shown how stable models for discrete time systems can be derived, and that the matching of power series parameters may not provide the closest fit to a step input response. The method of reduced order modeling described employs continuous time and discrete time procedures to obtain a hybrid low order model. Continuous time properties, such as stability results, can therefore be employed on discrete time models. ESA

N87-14931# Grenoble-1 Univ. (France). Lab. des Techniques de l'Informatique, des Mathematiques de la Microelectronique et de la Microscopie Quantitative.
FORMAL CALCULUS AND NUMBER OF ROOTS OF POLYNOMIALS IN THE UNIT DISK: APPLICATION TO AUTOMATISMS AND BIOCHEMISTRY Ph.D. Thesis [CALCUL FORMEL ET NOMBRE DE RACINES D'UN POLYNOME DANS LE DISQUE UNITE: APPLICATION EN AUTOMATIQUE ET BIOCHIMIE]
Bernard Gleyse 1986 208 p In FRENCH
(ETN-87-98587) Avail: NTIS HC A10/MF A01

Methods to compute polynomial roots using the Schur transformations and the Sturm and Schelin transformations are presented. Self-reciprocal polynomials are emphasized. Algorithm complexity is analyzed and a general method to compute the number of zeros as a function of a single parameter is described. The applications are discussed, showing the interest of the method to study the stability of biochemical or automatic systems. ESA

N87-14932# Technische Hogeschool, Delft (Netherlands). Lab. voor Technische Natuurkunde.
MEASUREMENT OF PARAMETERS FOR NONLINEAR OBJECT-SIZE FILTERS IN IMAGES [METINGEN VAN PARAMETERS VOOR NIET-LINEAIRE OBJECTGROOTTE-FILTERS IN BEELDEN]
A. L. D. Beckers Feb. 1986 135 p In DUTCH; ENGLISH summary
(ETN-87-98694) Avail: NTIS HC A07/MF A01

Methods to select objects in images on the basis of measurements on parameters describing primitive features of objects are presented. The information contained in the image with respect to these parameters is reviewed by measuring the values of the parameters in a well organized way, and gathering them in a parameter space. Nonlinear filters are very well suited to measurements on object parameters. The operation of these so-called measuring filters can be described by filter parameters that are sensitive and selective with respect to the object parameters. The size-height transformations can be used as a measuring tool, and the obtained spectrum can be helpful in the choice of the parameter values of the filters which select objects in images. ESA

N87-14254# National Aerospace Lab., Tokyo (Japan).
IMPLICIT TIME-MARCHING METHODS FOR THE TRANSONIC EULER EQUATIONS
Hisaaki Daiguji *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 51-60 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14258# National Aerospace Lab., Tokyo (Japan).
AN EASILY VECTORIZABLE NUMERICAL SOLUTION OF THE EULER EQUATIONS
Koji Morinishi, Nobuyuki Satofuka, and Hidetoshi Nishida *In its*

Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 89-95 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

N87-14270# National Aerospace Lab., Tokyo (Japan).
DIRECT NUMERICAL CONTROL IN GRID GENERATION
Yoshiaki Kodama *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 209-216 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N87-14933# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
DETECTION OF OUTLIERS IN MULTIVARIATE LINEAR REGRESSION MODEL
Dayanand N. Naik Apr. 1986 10 p
(Contract F49620-85-C-0008)
(AD-A170030; TR-86-11; AFOSR-86-0359TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This article suggests multivariate kurtosis measure as a statistic for detection of outliers in a multivariate linear regression model. The statistics has some local optimal properties. GRA

N87-14934# State Univ. of New York, Stony Brook. Stony Brook Dept. of Applied Mathematics and Statistics.
A NOTE ON BAYES EMPIRICAL BAYES ESTIMATION BY MEANS OF DIRICHLET PROCESSES Research Report, Jul. 1984 - Sep. 1985
Lynn Kuo 23 Sep. 1985 21 p
(Grant AF-AFOSR-0136-84; AF Proj. 2304)
(AD-A170039; AMS-85-60; AFOSR-86-0425TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bayes estimators are derived by means of the Dirichlet process hyperprior approach for general empirical Bayes problems. For any sample size, these estimators are expressed concisely as ratios of two multidimensional integrals. A numerical example on Poisson sampling is given. Author (GRA)

N87-14935# Florida State Univ., Tallahassee. Dept. of Statistics.
EASILY STATED BUT HARD STATISTICAL PROBLEMS
Myles Hollander May 1986 20 p
(Contract F49620-85-C-0007)
(AD-A170057; FSU-STATISTICS-M727; TR-86-188-AFOSR; AFOSR-86-0442TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is an expository paper written in response to an invitation to give a non-technical talk in a session devoted to Practical Aspects of Statistics at the 1986 Annual Statistical Meetings. The goal of the session is to encourage interest in statistics among non-statisticians. The author chose to describe three problems of current research interest. The problems have the feature that they can be stated in a relatively easy fashion. The solutions however are difficult. References to partial solutions are given; all three problems have aspects that remain unsolved and are currently under study. The problem of Section 2 deals with survivorship data and concerns estimation of average remaining life. Section 3 considers a problem that pertains to assessing the degree of similarity between species' presence or absence on islands. Section 4 presents a problem in geometrical probability. To conform to the spirit of the session, I have chosen to describe the problems in words, de-emphasizing symbols and mathematics and aiming for the non-statistician. Author (GRA)

N87-14936# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON STRONGLY CONSISTENT ESTIMATES OF REGRESSION COEFFICIENTS WHEN THE ERRORS ARE NOT INDEPENDENTLY AND IDENTICALLY DISTRIBUTED
Yuehua Wu Mar. 1986 26 p
(Contract F49620-85-C-0008)
(AD-A170076; TR-86-06; AFOSR-86-0393TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, the author proposes two methods of estimation of the regression coefficients when the errors are not distributed identically and independently and are of nonzero mean. The estimates provided in this paper are shown to be strongly consistent and mean square consistent. GRA

N87-14937# Illinois Univ., Chicago. Dept. of Mathematics, Statistics and Computer Science.
OPTIMAL ALLOCATION OF MULTISTATE COMPONENTS
Emad El-Neweihi, Frank Proschan, and Jayaram Sethuraman Sep. 1985 14 p
(Grant AF-AFOSR-0170-80)
(AD-A170081; TR-85-4; AFOSR-86-0424TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents some results in the optimal allocation of multistate components to k series systems so that some performance characteristic like expected number of systems functioning at level alpha or higher, the probability that at least one of the systems functions at level apha or higher, etc. is maximized. Our basic mathematical tools are majorization and Schur functions. These results may be used to obtain fruitful applications in reliability theory. GRA

N87-14938# Florida State Univ., Tallahassee. Dept. of Statistics.
STATIONARY MARKOV SETS
Michael I. Taksar Apr. 1986 39 p
(Contract F49620-85-C-0007)
(AD-A170109; FSU-STATISTICS-M705; TR-86-187-AFOSR; AFOSR-86-0366TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A Markov set is a random set on a real line whose future shape is conditionally independent of the past shape given present. Such sets appear in the study of visiting times of special Markov (but not strong Markov) processes. If the Markov process is stationary then the corresponding set is also stationary, that is, its distribution does not depend on the choice of the origin on the real line. In this paper we will describe all closed stationary Markov sets. We will show that each stationary Markov which is not regenerative can be constructed from two special regenerative sets by either taking a mixture of these regenerative sets or taking a superposition of two regenerative sets. Superposition can be described loosely as cutting two real lines R1 and R2 with two sets M1 and M2 in them, into pieces of iid length and then combine them into one line alternating pieces from R1 and R2. The union of the cut offs from M1 and M2 will be the superposition of the sets M1 and M2. GRA

N87-14939# Arizona Univ., Tucson. Dept. of Mathematics.
STOCHASTIC CONVEXITY AND ITS APPLICATIONS
Moshe Shaked and J. G. Shanthikumar 10 Dec. 1985 35 p
(Grant AF-AFOSR-0205-84)
(AD-A170112; AFOSR-86-0345TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several notions of stochastic convexity and concavity and their properties are studied in this paper. Efficient sample path approaches are developed in order to verify the occurrence of these notions in various applications. Numerous examples are given. The use of these notions in several areas of probability and statistics is demonstrated. In queueing theory, the convexity (as a function of c) of the steady state mean waiting time in a GI/D/c queue, and as a function of the arrival and service rates in a GI/G/1 queue, is established. Also the convexity of the queue length in the M/M/c case as a function of the arrival rate is shown, thus strengthening previous results while simplifying their derivation. In reliability theory, the convexity of the payoff on the success rate of an imperfect repair is obtained and used to find

an optimal repair probability. Also the convexity of the damage as a function of time in a cumulative damage shock model is shown. In branching processes, the convexity of the population size as a function of a parameter of the offspring distribution is proved. In nonparametric statistics, the stochastic concavity (convexity) of the empirical distribution function is established. And, for applications in the theory of probability inequalities, we identify several families of distributions which are convexly parametrized. GRA

N87-14940# South Carolina Univ., Columbia. Dept. of Statistics.
REGENERATIVE SAMPLING AND MONOTONIC BRANCHING PROCESSES
Stephen D. Durham and Kai F. Yu May 1986 30 p
(Grant AF-AFOSR-0156-84)
(AD-A170145; TR-118; AFOSR-86-0429TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A regenerative sampling plan is proposed for the sequential comparison of two populations having positive integral response. It is designed to be both an extension and an improvement of the play-the-winner rules for binary trials in the sense that a much wider variety of responses is allowed, the fraction of inferior selections approaches zero, and the play-the-winner rule is contained as a special case. Almost sure convergence and moment convergence in the pth order is studied for the fraction of inferior selections and for a maximum likelihood estimator of the mean response. A conditional test of hypothesis is given for the binary case. Author (GRA)

N87-14941# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ANALYSIS OF SIMULATED ANNEALING FOR OPTIMIZATION
Saul B. Gelfand and Sanjoy K. Mitter Sep. 1985 34 p
(Grants DAAG29-82-0135; AF-AFOSR-0258-82)
(AD-A170174; LIDS-P-1494; AFOSR-86-0349TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Simulated annealing is a popular Monte Carlo algorithm for combinatorial optimization. The annealing algorithm simulates a nonstationary finite state Markov chain whose state space is the domain of the cost function to be minimized. We analyze this chain focusing on those issues most important for optimization. In all of our results we consider an arbitrary partition optimization: important special cases are when I is the set of minimum cost states or a set of all states with sufficiently small cost. We give a lower bound on the probability that the chain visits I at some time. This bound may be useful even when the algorithm does not converge. We give conditions under which the chain converges to I in probability and obtain an estimate of the rate of convergence as well. We also give conditions under which the chain visits I infinitely often, visits I almost always, or does not converge to I with probability 1. Author (GRA)

N87-14942# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
NORMALIZING TRANSFORMATIONS OF SOME STATISTICS OF GAUSSIAN ARMA PROCESSES
M. Taniguchi, P. R. Krishnaiah, and R. Chao Feb. 1986 24 p
(Contract F49620-85-C-0008)
(AD-A170184; TR-86-05; AFOSR-86-0395TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, the authors investigate Edgeworth type expansions of certain transformations of some statistics of Gaussian ARMA processes. They also investigated transformations which will make the second order part of the Edgeworth expansions vanish. Some numerical studies are made and they show that the above transformations give better approximations than the usual approximation. Author (GRA)

N87-14943# Maryland Univ., College Park. Center for Automation Research.
RANDOM FIELD IDENTIFICATION FROM A SAMPLE. 1: THE INDEPENDENT CASE
Millu Rosenblatt-Roth Nov. 1985 25 p
(Contract F49620-85-K-0009)
(AD-A170185; CAR-TR-166; CS-TR-1583; AFOSR-86-0386TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given a random field belonging to some specific class, and given a data sample generated by the random field, the author considers the problem of finding a field of the given class that approximates the field that generated the sample. This paper derives a solution to this problem for the simple case of a field consisting of independent random variables. Subsequent papers will treat other types of fields, e.g., having Markov dependencies. Numerical examples are given, showing that good approximations can be obtained based on relatively small sample sizes. In particular, this approach can be used to find random field models that generate given samples of image texture, and so can be applied to texture classification or segmentation. Author (GRA)

N87-14944# South Carolina Univ., Columbia. Dept. of Statistics.
ON PREDICTION INTERVALS FOR FUTURE OBSERVATIONS FROM THE INVERSE GAUSSIAN DISTRIBUTION Interim Technical Report
W. J. Padgett and S. H. Tsoi Jan. 1986 12 p
(Grant AF-AFOSR-0156-84)
(AD-A170209; TR-109; Rept-62F25-1; AFOSR-86-0412TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of predicting, on the basis of an observed sample of size n from an inverse Gaussian distribution, a future observation from the same distribution is discussed. Two prediction intervals that have been proposed in the literature, one of which is an approximate prediction interval, are compared using Monte Carlo simulations. The results indicate that in many of the simulated cases the approximate prediction interval is superior with respect to larger estimated coverage probabilities and smaller estimated mean lengths. This is true in particular for n at least 15 and for 95% and 99%. GRA

N87-14945# Stanford Univ., Calif. Dept. of Statistics.
ON THE RELATION BETWEEN SEVERAL STATISTICS FOR TESTING FOR EXPONENTIALITY AND UNIFORMITY
Iain D. Currie and Michael A. Stephens 15 Jul. 1986 12 p
(Contract N00014-86-K-0156)
(AD-A170259; TR-377) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that Greenwood's statistic for uniformity and the Hahn-Shapiro and Stephens statistics for exponentiality with known origin are equivalent. It is also shown that the distribution of the Shapiro-Wilk statistic for testing the hypothesis of exponentiality with unknown origin is obtainable from Greenwood's distribution. Author (GRA)

N87-14946# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Applied Mathematics.
EQUILIBRIUM AND EXTINCTION IN STOCHASTIC POPULATION DYNAMICS
H. Roozen Apr. 1986 25 p
(CWI-AM-R8602; B8669755; ETN-86-98679) Avail: NTIS HC A02/MF A01

Stochastic models of interacting biological populations, with birth and death rates depending on the population size, are studied in the quasi-stationary state. Confidence regions in the state space are constructed by a method for the numerical solution of the ray equations. The concept of extinction time, which is closely related to the concept of stability for stochastic systems, is discussed. Results of numerical calculations for two-dimensional stochastic population models are presented. ESA

N87-14947# Research Inst. of National Defence, Stockholm (Sweden).
MODEL FOR DESCRIBING PROBABILITY DISTRIBUTIONS IN CHAINS OF EVENTS
Sven Wahlborn Jul. 1986 36 p
(FOA-C-20619-2.6(2.7); ISSN-0347-3694; ETN-86-98560) Avail: NTIS HC A03/MF A01

A method for representing a general class of probability distributions by linear expansion in terms of simple base functions, related to the chi-square distribution is presented. Convolution, i.e., forming distributions of sums of independent variables, computer calculations, and description of experimental data are facilitated. The method is especially useful for finding approximate probability distributions for use in chains of events. Illustrations of detection probabilities as functions of time or distance variables are presented. It is suggested that the method can also be extended to a model: analytic expressions and test functions can be formed. One application is the study of the effect of camouflage and other factors on the functioning of sensor systems. ESA

N87-14948# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).
APPLICABILITY AND LIMITATIONS OF PROBABILISTIC MODELS IN CONNECTION WITH THE RELIABILITY OF LARGE INSTALLATIONS Final Report [EINSATZMOEGLICHKEITEN UND GRENZEN VON PROBABILISTISCHEN MODELLEN IM ZUSAMMENHANG MIT DER ZUVERLAESSIGKEIT GROSSTECHNISCHER ANLAGEN]
E. Baudenistel and W. Schmitt Aug. 1985 81 p In GERMAN
(Contract BMFT-1500-637-8)
(W-7/85; ETN-87-98735) Avail: NTIS HC A05/MF A01

Probabilistic method and failure theories are discussed with emphasis on embrittlement and ductile fractures. Analytical models for the growth of isolated voids were developed in order to describe the ductile failure. The analytical description requires extensive limitations with respect to materials behavior and geometry and leads to a limited validity of the results. Numerical models (e.g., using the finite element method) were developed in order to allow quantitative predictions about the effect of the microstructure on the scattering of global materials characteristics. The developed program system OCA-P allows deterministic as well as probabilistic reliability analyses of installations and components with cracks. ESA

N87-14949# Grenoble-1 Univ., Saint Martin d'Heres (France). Lab. des Techniques de l'Informatique, des Mathematics.
ORDER OF STRONG CONVERGENCE OF LEAST SQUARES ESTIMATES IN STOCHASTIC REGRESSION MODELS FOR SEMIMARTINGALES
A. LeBreton and M. Musiela Dec. 1985 19 p
(RR-608-IMAG-M; ETN-87-98575) Avail: NTIS HC A02/MF A01

Multiple linear regression models with stochastic regressors and a continuous time martingale as process of errors are considered. The strong consistency of least squares estimates is established. The application to identification of a continuous-time autoregressive model is investigated. ESA

N87-14950# Grenoble-1 Univ. (France).
BINARY TIME SERIES WITH REWARD. APPLICATION TO CLIMATOLOGY MODELING Ph.D. Thesis [SERIES CHRONOLOGIQUES BINAIRES AVEC RECOMPENSES. APPLICATIONS A LA MODELISATION EN CLIMATOLOGIE]
Khalid ElHimdi 1986 200 p In FRENCH Sponsored by CNRS
(ETN-87-98588) Avail: NTIS HC A09/MF A01

A reward describing the climatological variable (rain intensity) is associated to the binary statistical variable in order to formulate an accurate model. Markov chain models are extended to binary time series with renewed rewards. The results are used to analyze time series from two weather stations. The results show a better description of data characteristics. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N87-14951# Royal Aircraft Establishment, Farnborough (England).
A MONOGRAPH ON KEPLER'S EQUATION
R. H. Gooding and A. W. Odell Oct. 1985 86 p
(RAE-TR-85080; RAE-Space-651; BR99104; ETN-86-98611) Avail: NTIS HC A05/MF A01

Methods for solving Kepler's equation are reviewed, especially iterative procedures that are fast and accurate for any value of eccentricity up to (and including) unity. The best of the procedures looked at consists of a starting formula tailored to eccentricities of zero and unity, together with two iterations of a process with quartic convergence. The truncation error in the resulting solution then never exceeds 7 x 10 to the minus 15th rad (4 x 10 to the minus 13th deg). ESA

N87-14952# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
INTERTWINING FUNCTIONS IN COMPACT LIE GROUPS AND MULTIVARIABLE ORTHOGONAL POLYNOMIALS [FONCTIONS D'ENTRELACEMENT SUR LES GROUPES DE LIE COMPACTS ET POLYNOMES ORTHOGONAUX DE PLUSIEURS VARIABLES]
Bob Hoogenboom and Tom H. Koornwinder Jan. 1986 19 p In FRENCH; ENGLISH summary Presented at a Conference, Tunis, Tunisia, 27 Aug.-15 Sep. 1984 Submitted for publication
(CWI-PM-R8601; B8669756; ETN-86-98680) Avail: NTIS HC A02/MF A01

It is shown that spherical functions and intertwining functions on compact symmetric spaces can be written as orthogonal polynomials in several variables. It is also shown that orthogonal polynomials in several variables can be associated with root systems. ESA

N87-14953# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
DEFORMATIONS OF CONNECTIONS, THE RIEMANN HILBERT PROBLEM AND tau FUNCTIONS
Gerard F. Helminck Jan. 1986 19 p Presented at the 7th International Symposium on the Mathematical Theory of Networks and Systems, Stockholm, Sweden, 10-14 Jun. 1985
(CWI-PM-M8602; B8669757; ETN-86-98681) Avail: NTIS HC A02/MF A01

Sufficient conditions for the existence of integrable deformations of a rotational linear ordinary differential equation on the projective line are given. It is shown when the related connection form obtains a reduced form. Certain coefficients in this reduced form admit a meromorphic continuation to the whole parameter space, while their poles coincide with the zero-set of a Fredholm determinant tau. These properties are similar to the ones holding for the solutions of the KP-hierarchy and form a generalization of work by Malgrange (1983). ESA

N87-14954# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
CONSTRAINED NORMALIZATION OF HAMILTONIAN SYSTEMS AND PERTURBED KEPLERIAN MOTION
Jan-Cees vanderMeer and Richard Cushman (Utrecht State Univ. (Netherlands).) Jan. 1986 20 p Submitted for publication
(CWI-PM-R8603; B8669758; ETN-86-98682) Avail: NTIS HC A02/MF A01

The Hamiltonian system (HR sup 2n omega) is considered. Let M be a sympletic submanifold of (R sup 2n omega). The system constrained to M is (H/M, M, omega/M). An algorithm which normalizes the system on R2n in such a way that restricted to M it normalizes the constrained system is given. This procedure is then applied to normalizing perturbed Kepler systems such as the lunar problem and the main problem of artificial satellite theory. ESA

N87-14955# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
MULTIGRID SOLUTION OF MONOTONE SECOND-ORDER DISCRETIZATIONS OF HYPERBOLIC CONSERVATION LAWS
S. P. Spekreijse Apr. 1986 22 p Submitted for publication
(CWI-NM-R8611; B8671259; ETN-86-98684) Avail: NTIS HC A02/MF A01

The construction of second-order accurate monotone upwind schemes for hyperbolic conservation laws and the multigrid solution of the resulting discrete steady state equations are considered. By the use of an appropriate definition of monotonicity, it is shown that there is no conflict between second-order accuracy and monotonicity (neither in one nor in more dimensions). It is shown that a symmetric block Gauss-Seidel underrelaxation (each block is associated with four cells) has satisfactory smoothing rates. The success of this relaxation is due to the fact that, by coupling the unknowns in such blocks, the nine-point stencil of a second-order two dimensional upwind discretization changes into a five-point block stencil. ESA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N87-14956*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FINITE ELEMENT MODELING OF ELECTROMAGNETIC PROPAGATION IN COMPOSITE STRUCTURES
Kenneth J. Baumeister 1987 7 p Proposed for presentation at the AP-S International Symposium, Blacksburg, Va., 15-19 Jun. 1987; sponsored by IEEE
(NASA-TM-88916; E-3341; NAS 1.15:88916) Avail: NTIS HC A02/MF A01 CSCL 46O

A finite element Galerkin formulation has been developed to study electromagnetic propagation in complex two-dimensional absorbing ducts. The reflection and transmission at entrance and exit boundaries are determined by coupling the finite element solutions at the entrance and exit to the eigenfunctions of an infinite uniform perfect conducting duct. Example solutions are presented for electromagnetic propagation with absorbing duct walls and propagating through dielectric-metallic matrix materials. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N87-14957*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-SPEED PROPELLER NOISE PREDICTIONS: EFFECTS OF BOUNDARY CONDITIONS USED IN BLADE LOADING CALCULATIONS
M. Nallasamy (Sverdrup Technology, Inc., Cleveland, Ohio.), B. J. Clark, and J. F. Groeneweg 1987 26 p Presented at the 25th Aeropace Sciences Meeting, Reno, Nev., 12-15 Jan. 1987; sponsored by AIAA
(NASA-TM-88913; E-3337; NAS 1.15:88913; AIAA-87-0525) Avail: NTIS HC A03/MF A01 CSCL 20A

The acoustics of an advanced single rotation SR-3 propeller at cruise conditions are studied employing a time-domain approach. The study evaluates the acoustic significance of the differences in blade pressures computed using nonreflecting rather than hard wall boundary conditions in the three-dimensional Euler code solution. The directivities of the harmonics of the blade passing frequency tone and the effects of chordwise loading on tone directivity are examined. The results show that the maximum difference in the computed sound pressure levels due to the use of blade pressure distributions obtained with the nonreflecting rather than the hard wall boundary conditions is about 1.5 dB. The blade passing frequency tone directivity obtained in the present study shows good agreement with jetstar flight data. Author

N87-14958# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Technische Akustik.
NOISE CERTIFICATION AND NOISE SENSITIVITY STUDIES ON THE BO-105 HELICOPTER
Wolf R. Splettstoesser, Klaus-Peter Anders, and Karl-Heinz Spiegel Jun. 1985 109 p In GERMAN; ENGLISH summary
(DFVLR-Mitt-86-13; ISSN-0176-7739; ETN-86-98752) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany DM 34

Noise measurements were performed on the BO-105 helicopter in compliance with the International Civil Aviation Organization (ICAO) standard for noise certification. The measurement procedure, and the noise data acquisition, analysis, and reduction, as well as the applied correction procedures are described. The Effective Perceived Noise Levels (EPNL) were evaluated and related to the proposed ICAO noise limits. Additional noise tests were conducted by varying flight and operational parameters such as gross weight, flight altitude, air speed, and rotor speed beyond the range specificied by the standard. The sensitivity of the EPNL to these parameters is discussed. ESA

N87-14959# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
AN EXPERIMENTAL INVESTIGATION OF NOISE GENERATION AND NOISE REDUCTION IN A PIPE FLOW BEHIND A DISCONTINUOUS AREA ENLARGEMENT
Bernhard Stahl and Gustavo Argueello May 1986 47 p In GERMAN; ENGLISH summary Sponsored bu Deutschen Forschungsgemeinschaft
(DFVLR-FB-86-27; ISSN-0171-1342; ETN-87-98856) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Germany DM 14.50

Flow separation downstream of a discontinuous enlargement in the circular cross-sectional area of a pipe was studied. The turbulence is a source of plane waves and higher acoustical modes. Microphone measurements were made to study the pressure fluctuations in the compact source region of the acoustic waves, and the aerodynamically generated acoustic field behind the discontinuous enlargement is shown to dominate far downstream. The vibrations of the acoustical modes are discussed, and damping techniques using simple geometrical shapes are tested. ESA

N87-14960# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
NOISE DEVELOPMENT IN TRANSONIC FLOWS AT THE IMPACT OF VORTICES ON A PROFILE LEADING EDGE Thesis [SCHALLENTSTEHUNGSMECHANISMEN IN TRANSSONISCHEN STROEMUNGEN BEIM AUFTREFFEN VON WIRBELN AUF EINE PROFILVORDERKANTE]
H.-M. Lent May 1986 61 p In GERMAN
(MPIS-5/1986; ISSN-0436-1199; ETN-87-98866) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 36

The production of noise in the interaction of a vortex with the leading edge of a profile in a transonic flow was investigated. The occurring phenomena are detected in the far field as noise (blade-vortex interaction noise). The vortex was produced as a von Karman vortex street in the wake of a rectangular cylinder. The interferograms show a strong shock-like pressure wave in a broad parameter range after the passing of the leading edge by the vortex; this is probably the most important mechanism of the down stream pulse noise as, e.g., observed for helicopters and can thus easily be simulated in experiments. The development of weaker shocks at the profile were also observed downstream; this phenomenon does not seem to be important for the noise production. The measurement of the pressure distribution in the

unsteady potential flow shows similarities with the theory with respect to the dipole-like noise radiation characteristic; however there are significant differences in the details, probably due to the neglect of compressibility and friction. ESA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N87-14961# Georgia Univ., Athens.
COHERENT PHONON GENERATION AND HIGH FREQUENCY PHONON SPECTROSCOPY Final Report, 29 Mar. 1982 - 28 Sep. 1985
John E. Rives, Richard S. Meltzer, and David P. Landau 18 Mar. 1986 20 p
(Contract DAAG29-82-K-0088)
(AD-A169031; ARO-18822.4-PH) Avail: NTIS HC A02/MF A01 CSCL 20/12

A number of optical techniques have been developed in recent years which have been applied to study the dynamics of high frequency phonons. Monoenergetic phonons were generated by spin-lattice relaxation between two electronically excited states of an impurity ion. Resonant trapping provided the means to detect these phonons with good temporal resolution. VSPS was used to detect high frequency phonons over a wide frequency range with excellent temporal, spectral and spatial resolution. The life-time of a monoenergetic non-equilibrium distribution of phonons was determined by the observation of optical dephasing, using free induction decay(FID), which results from phonon induced coherence loss(PICOLO). Non-resonant fluorescence line narrowing (FLN) techniques provided a means to determine the spectral distribution of non-equilibrium phonons generated by spin lattice relaxation. GRA

N87-14962# State Univ. of New York, Buffalo. Dept. of Chemistry.
PHOTODISSOCIATION OF MOLECULES AT STRUCTURED METALLIC SURFACES Interim Report
P. T. Leung and Thomas F. George Jun. 1986 22 p
(Contract N00014-86-K-0043)
(AD-A169623; UBUFFALO/DC/86/TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/5

Direct photodissociation of molecules at structured metallic surfaces is considered, where the concepts of optimal and critical distances are introduced into the description of this phenomenon. Numerical results for the distortion of the line shape and the enhancement ratio are obtained for a shallow sinusoidal grating. GRA

N87-14963# Arkansas Univ., Fayetteville. Dept. of Chemistry and Biochemistry.
TIME-RESOLVED STUDIES OF MOLECULAR PROCESSES INVOLVING TRANSIENT SPECIES BY SYNCHRONOUSLY-PULSED OPTICAL EXCITATION AND DIAGNOSTIC ELECTRON SCATTERING Report, 15 Jun. 1985 - 14 Jun. 1986
14 Jun. 1986 19 p
(Contract N00014-85-K-0757)
(AD-A169624) Avail: NTIS HC A02/MF A01 CSCL 07/4

A Time Resolved Electron Diffractometer (TRED) is built to study the structures of short-lived, energetic molecular states and the dynamics of primary dissociation processes found in molecules of energetic materials. The experiments in preparation make use of the technology and techniques developed on our real time data acquisition Gas Electron Diffractometer (GED), which is currently the only one of its kind. In this instrument, a 40 keV, continuous, focused electron beam is crossed at right angles by a gaseous molecular beam, and the electron scattering pattern generated is converted to an optical image by a phosphor screen; this image is then transferred by a lens onto a 1024 element photodiode array (PDA). The channels of the PDA detect the angular dependence and intensity profile of the electron scattering along a radial line of the circularly symmetric pattern. This new procedure effectively replaces conventional photographic GED techniques. On line optimization of GED experimental conditions and ratiometric data analysis are essential for studying short lived energetic species and for performing time resolved investigations. GRA

N87-14964# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
LASER-SURFACE ADSORBATE INTERACTIONS: THERMAL VS. PHOTOELECTRONIC EXCITATION OF Mo(Co)6 ONSi(3)
C. E. Bartosch, Z. Ying, N. S. Gluck, and W. Ho Jun. 1986 16 p
(Contracts N00014-81-K-0505; N00014-85-G-0015)
(AD-A169641; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Laser induced electronic excitation of adsorbed Mo(CO)6 followed by Carbon Monoxide desorption is observed to occur on Si(111)7x7 irradiated with 257 nm (4.8 eV) laser radiation. The process is shown to be completely non-thermal in nature. In contrast, irradiation with 514 nm radiation is found to be identical to resistively heating the crystal. Adsorption does not quench the gas phase UV absorption-decomposition process, nor does it open up new excitation mechanisms that allow decomposition to occur in the visible region of the spectrum. GRA

N87-14965# Illinois Univ., Urbana. Dept. of Electrical and Computer Engineering.
RESEARCH ON A NEW TYPE OF NEGATIVE HYDROGEN ION SOURCE Final Report, 15 Jul. 1981 - 14 Jan. 1985
R. J. Turnbull May 1986 62 p
(Grant AF-AFOSR-0160-81)
(AD-A170068; AFOSR-86-0476TR) Avail: NTIS HC A04/MF A01 CSCL 07/2

The production of negative hydrogen ions in a discharge is greatly enhanced if the hydrogen is vibrationally excited hydrogen. The work presented here is a study of a method of producing vibrationally excited hydrogen. The technique used is to heat dense hydrogen hot enough to produce vibrational excitation and then allow it to expand thus cooling it while maintaining the vibrational excitation. Both theoretical calculations and experimental results of this technique are presented. GRA

N87-14966# Los Alamos National Lab., N. Mex.
RIEMANN PROBLEMS AND THEIR APPLICATION TO ULTRA-RELATIVISTIC HEAVY ION COLLISIONS
B. J. Plohr and D. H. Sharp Jul. 1986 7 p Presented at the 8th International Conference on Mathematical Physics, Marseilles, France, 16 Jul. 1986
(Contract W-7405-eng-36)
(DE86-013829; LA-UR-86-2575; CONF-860761-1) Avail: NTIS HC A02/MF A01

Heavy ion collisions at sufficiently high energies to form quark-gluon plasma are considered. The phase transformation from a quark-gluon phase to hadrons as the nuclear matter cools is modeled as a hydrodynamical flow. Nonlinear waves are the predominant feature of this type of flow and the Riemann problem of a relativistic gas undergoing a phase transformation is explored as a method to numerically model this phase transition process in nuclear matter. The solution of the Riemann problem is outlined and results of preliminary numerical computations of the flow are presented. DOE

N87-14967# Lawrence Livermore National Lab., Calif.
SCALING OF CURRENT DENSITY, TOTAL CURRENT, EMITTANCE, AND BRIGHTNESS FOR HYDROGEN NEGATIVE ION SOURCES
J. R. Hiskes 10 Jul. 1986 10 p Presented at the NATO Advanced Course on High Brightness Accelerators, Pitlochry, Scotland, 13 Jul. 1986
(Contract W-7405-eng-48)
(DE86-016010; UCRL-95364; CONF-860756-3) Avail: NTIS HC A02/MF A01

The atomic and molecular processes that play a principal role

in negative ion formation in a hydrogen negative ion discharge are discussed. The collisions of energetic electrons with gas molecules within the discharge lead to vibrationally excited molecules. Thermal electrons in turn attach to these excited molecules and generate negative ions via the dissociative attachment process. A system geometry chosen to optimize these collision processes is discussed that consists of a high-power discharge in tandem with a low electron temperature bath, the two regions separated by a magnetic filter. The current density extracted from such a system is found to scale inversely with the system scale length provided the gas density and electron density are also increased inversely with scale length. If a system is scaled downward in size to provide a new beamlet but one with increased current density, and these beamlets are packed to fill the original dimension, the new total extracted current will exceed the original total current by the scale factor. The emittance, epsilon, of the new system remains unchanged. The brightness, J/epsilon^2, of the new system will also be increased in proportion to the scale factor. DOE

N87-14968# Max-Planck-Institut fuer Strömungsforschung, Goettingen (West Germany).
SPECTROSCOPY OF THE PHONONS ON NOBLE GAS SURFACES USING HELIUM ATOMIC BEAM SCATTERING Thesis [SPEKTROSKOPIE DER PHONONEN AUF EDELMETALLOBERFLAECHEN MIT HELIUM-ATOMSTRAHL-STREUUNG]
U. Harten Feb. 1986 150 p In GERMAN
(MPIS-1/1986; ISSN-0436/1199; ETN-86-98223) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 31

Helium atomic beam scattering was used for the spectroscopy of eigenvibrations of noble metal surfaces. The experimental setup and basic observations concerning inelastic atomic beam scattering are explained. The most important result is the observation of 2 separated acoustic modes on the (111) surfaces of copper, silver, and gold. The first mode was theoretically predicted, while the second could only be reproduced in model calculations if the interatomic forces at a crystal surface were changed with respect to those in the volume. The excitation probabilities for the surface phonons are essentially determined by the interaction potential between the atoms and surface. ESA

N87-14335# Stuttgart Univ. (West Germany). Inst. fuer Thermodynamik der Luft- und Raumfahrt.
RELAXATION OF VIBRATIONAL DEGREES OF FREEDOM [RELAXATION VON SCHWINGUNGSFREIHEITSGRADEN]
Arnold Frohn *In its* Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives Apr. 1986 p 77-125 In GERMAN Previously announced as N83-34828 (For primary document see N87-14331 06-07)
Avail: NTIS HC A20/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N87-14969# Lawrence Livermore National Lab., Calif.
INERTIAL FUSION POWER FOR SPACE APPLICATIONS
W. R. Meier, W. J. Hogan, N. J. Hoffman, K. A. Murray, and R. E. Olson 19 May 1986 8 p Presented at the Intersociety Energy Conversion Engineering Conference, San Diego, Calif., 25 Aug. 1986 Prepared in cooperation with Rockwell International Corp., Canoga Park, Calif. and Sandia National Labs., Albuquerque, N. Mex.
(Contract W-7405-eng-48)
(DE86-011879; UCRL-94138; CONF-860810-22) Avail: NTIS HC A02/MF A01

More than thirty-seven design concepts have been proposed for terrestrial ICF power plants. The design space is large because of the many allowable driver and reaction chamber combinations. These design studies have illustrated advantages of ICF power plants over other sources in lower impact on the environment, high safety, and almost no dependence on consumables like fuel. The fact that, once built, a 1000 MW/sub e/ ICF power plant would require only 240 kg of deuterium and from 770 to 9260 kg of lithium to run for five years (at 70% capacity factor) makes it potentially attractive for space power also. However, the designs proposed to date have emphasized features that would make the plant attractive for terrestrial applications, where economics, efficiency, and environmental considerations dominate. The resulting plants are large and contain many very heavy components that would not be at attractive for space applications. In this paper, we evaluate alternative ICF driver and reactor technologies using space application criteria and also discuss how some of those technologies can be altered to produce smaller, lighter fusion power sources for space. DOE

N87-14970# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
CALIBRATION OF THE FAST 12-CHANNEL ELECTRON CYCLOTRON EMISSION (ECE) SPECTROMETER AT JOINT EUROPEAN TORUS (JET)
R. M. Niestadt, B. J. D. Tubbing, and Th. Oyevaar Jul. 1986 36 p Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-86-168; ETN-86-98725) Avail: NTIS HC A03/MF A01

Measurements on the 12-channel electron cyclotron emission grating polychromator at the Joint European Torus are reported. Spectrometer sensitivity and spectral resolution are described. Measures to improve system responsivity and to overcome characteristic problems of the spectrometer are outlined. Methods of absolute calibration of the system are compared, but no decision is taken. ESA

N87-14549# California Univ., Santa Barbara. Dept. of Chemical and Nuclear Engineering.
STRATIFICATION PHENOMENA AND ASSOCIATED HAZARDS
T. G. Theofanus *In* Von Karman Inst. for Fluid Dynamics Tow Phase Flows in Major Technological Hazards, Volume 2 1986 48 p Sponsored by NRC (For primary document see N87-14544 06-31)
Avail: NTIS HC A16/MF A01

74 OPTICS

N87-14971* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH-TEMPERATURE, HIGH-PRESSURE OPTICAL CELL Patent
Ronald P. Harris, Lawrence R. Holland (Alabama Univ., University.), and Robbie E. Smith, inventors (to NASA) Issued 30 Sep. 1986 7 p Filed 17 Jan. 1984 Supersedes N84-16986 (22 - 07, p 1075)
(NASA-Case-MFS-26000-1; US-Patent-4,614,428;
US-Patent-Appl-SN-571615; US-Patent-Class-356-246;
US-Patent-Class-372-61) Avail: US Patent and Trademark Office CSCL 20F

The invention is an optical cell for containment of chemicals under conditions of high temperature and high pressure. The cell is formed of a vitreous silica tube, two optical windows comprising a vitreous silica rod inserted into the ends of a tube, and fused into position in the tube ends. Windows are spaced apart to form a cavity enclosed by the tube and the windows. A hole is drilled radially through the tube and into the cavity. Another vitreous silica tube is fused to the silica tube around the hole to form the stem, which is perpendicular to the long axis of the tube. The open end of the stem is used to load chemicals into the cavity. Then the stem may be sealed, and if desired, it may be shortened

in order to reduce the volume of the cavity, which extends into the stem.Official Gazette of the U.S. Patent and Trademark Office

N87-14972*# California Univ., Berkeley. Space Sciences Lab.
FUSE/LYMAN GRANT Final Report
Mark Hurwitz and Stuart Bowyer 3 Nov. 1986 3 p
(Grant NAG5-420)
(NASA-CR-180024; NAS 1.26:180024) Avail: NTIS HC A02/MF A01 CSCL 20F

A variety of options for a short wavelength spectrometer for the Lyman telescope has been studied, and the optimum configuration for this instrument identified. In this spectrometer option study it is assumed (consistent with performance goals outlined by the project) that the instrument, whose prime spectral domain is 900-12000A, will incorporate a grazing incidence telescope which will maintain good collecting efficiency down to 100A. In particular it is assumed that the telescope will have an effective focal length of 10 meters, an image quality of 1.5', and will provide a diverging f/10 beam. Designs compatible with this telescope are analyzed, and it is determined that a two-element grazing incidence spectrometer using as its first optic an ellipsoid to re-focus the beam and a varied line-space plane diffraction grating to disperse the light is the best overall design. This spectrometer could be fed by a small pick-off mirror located just behind the prime focus of the telescope and would clear the light path when not in use. A test of the diffraction efficiency of a low blaze angle grating is undertaken, which is the only technical uncertainty in the spectrometer design. Author

N87-14973# Naval Ocean Systems Center, San Diego, Calif.
NONLINEAR PIXEL REPLACEMENT ESTIMATION
R. Cigledy Apr. 1986 87 p
(AD-A168882; NOSC/TD-879) Avail: NTIS HC A05/MF A01 CSCL 20/6

Optical surveillance sensors are sometimes subject to static noise processes which can adversely affect the optimal processing of their resulting imagery. For example, image intensity values derived from line outages, dead pixels, popcorn noise and other such noise mechanisms will contaminate both local and global estimates of the power spectrum density, probability density function and other key statistical properties inherent to the original observed scene. If these estimates are used to derive optimum filters for detecting specific targets in said imagery or registering sequences of images, poor processing performance could result. Excellent current image processing trends are discussed, which are dependent on good quality pictures. They illustrate their utility for enhancing the inherent information content found in remotely sensed images such as those taken by the LANDSAT and NIMBUS-7 satellites. They also show the effect of noisy pixels on these techniques and the types of performance degradations incurred, which can be significant. This suggests that methods for replacing the bad pixel values with numbers commensurate with the inherent statistics of a detected image can be important to optimum imagery. GRA

N87-14974# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
STUDIES OF PHASE-CONJUGATE OPTICAL DEVICE CONCEPTS Annual Technical Report, 1 Apr. 1985 - 31 Mar. 1986
Pochi Yeh and McMichael, Ian Jun. 1986 116 p
(Contract N00014-85-C-0219)
(AD-A170203; SC5424.AR) Avail: NTIS HC A06/MF A01 CSCL 20/6

This contract studies the phase-reversal property of optical phase conjugation for navigational and other device applications. The study focuses on the development of the phase-conjugate fiber-optic gyro and the generation of new device concepts. Although much attention is paid to the aberration correction property of phase conjugation, little attention is paid to the phase reversal property. The phase-reversal property has important applications in inertial navigation devices. The general problem for this program is to generate new device concepts using the phase-reversal property of phase conjugation. Polarization scrambling is a well-known source of noise and signal fading in fiber-optic gyros. Some gyros avoid this problem by using polarization-preserving fibers and couplers to decouple the polarization modes. This program studies a new approach in which polarization-preserving phase conjugation is used to correct for polarization scrambling without the need for polarization-preserving fibers and couplers. There are several areas of significant progress in the first year of this program that are directly related to the development of the phase-conjugate fiber-optic gyro. These include: First experimental observation of the phase-conjugate Sagnac phase shift; and first demonstrations of rotation sensing with a phase-conjugate gyro and with a self-pumped phase-conjugate fiber-optic gyro. GRA

N87-14975# Physical Sciences, Inc., Andover, Mass.
INFRARED OPTICAL PROPERTY MEASUREMENT TECHNIQUES. DEFINITION AND PRELIMINARY DESIGN Final Report, Aug. 1985 - Mar. 1986
T. E. Parker, D. I. Rosen, and W. T. Rawlins Jul. 1986 86 p
(Contract F04611-85-C-0060)
(AD-A170426; PSI-060/TR-559; AFRPL-TR-86-034) Avail: NTIS HC A05/MF A01 CSCL 21/2

An experimental design for the determination of the complex indices of refraction for small particles as a function of wavelength and temperature is presented. The temperature ranges of interest are 300 to 500 K and 1000 to 3000 K for wavelengths spanning 0.3 to 10 micrometers. Particulate species are pure form Al2O3, ZrO2, MgO, C, and ZrC in addition to rocket exhaust derived particles; the radii for these particles will span 0.1 to 10 micrometers. Proposed high temperature experiments would be performed in a shock tube. A particle injector conceptual design for producing particulate dispersions over short lengths of the shock tube is presented and would be used in conjunction with the experiments. Optical response and sensitivity to index of refraction of the particulate species is investigated in detail and used to guide the optical diagnostic design. Finally, a methodology for determining the complex indices of refraction based upon experimental results is presented with the recommendations for the optical diagnostic package. GRA

N87-14976# Department of the Air Force, Washington, D.C.
OPTICAL GAUSSIAN CONVOLVERS Patent Application
Jay P. Sage, inventor (to Air Force) Filed 3 Jun. 1986 14 p
(AD-D012438; US-Patent-Appl-SN-870047) Avail: NTIS HC A02/MF A01 CSCL 14/5

The variable Gaussian convolution of an optical image is performed using a transparency, a focusing lens, a TV camera and a mechanism which moves the camera. The transparency has pattern inscribed on it which diffracts the light of the image with a Gaussian function of radius. The focusing lens receives the diffracted image from the transparency and focuses it. The camera receives the Gaussian convolution of the optical image from the focusing lens by being initially positioned along the optical axis of the lens at the focal length of the lens. As the camera is shifted to variable positions by the mechanism, the size of the Gaussian function increases as the camera is moved towards the lens, and is decreased as the camera is moved away from the lens. GRA

N87-14977# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ION ASSISTED DEPOSITION OF OPTICAL COATINGS Ph.D. Thesis
James J. McNally Aug. 1986 178 p
(AD-A170672; AFIT/CI/NR-86-77D) Avail: NTIS HC A09/MF A01 CSCL 20/6

The effects on the properties of Ta2O5, Al2O3, SiO2 and HfO2 single- and multi-layer optical coatings deposited using ion assisted deposition (IAD) were investigated. IAD is a novel deposition technique which utilizes a separate ion source to direct a beam of ions at the growing film. A Kaufman ion source was used to provide a monoenergetic, neutralized beam of oxygen ions independent of the material evaporation process. The optical and physical properties, as well as laser induced damage threshold

(LIDT) values, were studied for coatings bombarded with 200, 300, 500 and 1000 eV oxygen ions at values of current density from 0 to 200 microAmp/sq cm. IAD was successfully applied to deposit coatings at low temperature on heavy metal fluoride (HMF) glass substrates. The coatings deposited using IAD were hard and dense. The IAD coatings improved the durability and abrasion resistance of the HMF glass substrates. The results of this investigation show that IAD can be used to improve the optical and physical properties of optical coatings. GRA

N87-14978# Pennsylvania State Univ., University Park. Dept. of Meteorology.
SUM RULES FOR OPTICAL EXTINCTION AND SCATTERING BY SMALL PARTICLES Annual Report, 16 May 1984 - 16 May 1985
Craig F. Bohren 18 Mar. 1986 25 p
(Grant AF-AFOSR-0145-84)
(AD-A170815; AFOSR-86-0517TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

The solution to the problem of scattering by an arbitrary homogeneous sphere (Mie theory) yields an infinite set of coefficients. These scattering coefficients depend on various Bessel functions and their derivatives. The usual approach to computing scattering coefficients is to compute the Bessel functions by recurrence. The Bessel functions in the expressions for the scattering coefficients satisfy recurrence relations. It has been shown that the scattering coefficients themselves satisfy recurrence relations. Whether or not the recurrence relations can simplify scattering calculations must be determined by extensive calculations. It is not known if the recurrence relations are stable, either upward or downward. These matters are for further investigation. GRA

N87-14979# GTE Labs., Inc., Waltham, Mass.
PROCESSING STUDIES FOR OPTICALLY TRANSPARENT LA(2)O(3)-DOPED Y(2)O(3) Final Report, 1 Jun. 1982 - 31 May 1986
W. H. Rhodes, E. A. Trickett, and G. C. Wei 31 Jul. 1986 176 p
(Contract N00014-82-C-0452)
(AD-A170821; TR-86-818.1) Avail: NTIS HC A09/MF A01 CSCL 20/6

The processing and properties of La2O3-doped Y2O3 were studied with emphasis on increased understanding and control of processing to achieve improved optical and mechanical properties. The program resulted in a successful demonstration of prototype infrared windows. GRA

N87-14980# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
FEASIBILITY INVESTIGATION INTO THE USE OF A LIQUID CRYSTAL TELEVISION AS A SPATIAL LIGHT MODULATOR M.S. Thesis
Edward R. Raudenbush 1986 61 p
(AD-A170898; AFIT/CI/NR-86-94T) Avail: NTIS HC A04/MF A01 CSCL 20/6

The recent availability of inexpensive, electrically addressable liquid crystal displays has generated interest in the use of such devices for optical processing applications. Characterizations pertinent to this use include: maximum obtainable modulation depth, modulation transfer function (MTF), linearity of response, refresh cycle time and optical flatness. Examples of device performance as a coherent processor and as an incoherent processor will be given. Author (GRA)

N87-14981# Pennsylvania Univ., Philadelphia. Electro-optics and Microwave-optics Lab.
RESEARCH IN IMAGE UNDERSTANDING AS APPLIED TO 3-D MICROWAVE TOMOGRAPHIC IMAGING WITH NEAR OPTICAL RESOLUTION Annual Report, 1 Sep. 1984 - 31 Jul. 1985
N. H. Farhat 10 Mar. 1986 72 p
(Grant AF-AFOSR-0240-81)
(AD-A173063; EO/MO-8; AFOSR-86-0843TR) Avail: NTIS HC A04/MF A01 CSCL 17/9

The objective of research under this grant is to achieve fundamental understanding of the dynamics of coherent and incoherent image formation and inverse scattering employing spectral, angular (aspect dependent) and polarization diversity as means for realizing cost-effective imaging of 3-D objects with near optical resolution. Special attention is to be given to 3-D microwave diversity radar imaging. The approach is Theoretical through development of a unified theory of microwave diversity imaging for both stationary and non-stationary objects which has been reported on extensively in preceeding reports and, Experimental - through development and verification of methodologies for efficient microwave diversity imaging that can be employed in future broad-band imaging radar networks capable of providing 3-D projective or tomographic images of remote aerospace targets with near optical resolution. GRA

N87-14982# EG and G Energy Measurements, Inc., Las Vegas, Nev.
UNIQUE COUPLER EVALUATION TECHNIQUES AND RESULTS
B. M. Whitcomb, R. L. Flurer, C. W. Colburn, and D. L. Elliott 1986 5 p Presented at the Symposium on Optical Fiber Measurements, Boulder, Colo., 9 Sep. 1986
(Contract DE-AC08-83NV-10282)
(DE86-012101; EGG-10282-1109; CONF-860982-1) Avail: NTIS HC A02/MF A01

Fiber optic couplers have been used for a variety of purposes in diagnostic experiments at the Nevada Test Site (NTS). Because they are not always used in the precise manner for which they were originally built and characterized, they must be characterized more fully than a similar component used in typical telecommunication's application. The results presented in this paper illustrate the need for complete characterization. Methods are described which provide adequate characterization to allow for the unique application of these components. DOE

N87-14983# Brigham Young Univ., Provo, Utah.
CURVED SILICON SUBSTRATES FOR MULTILAYER STRUCTURES
R. C. Woodbury, H. Fan, L. V. Knight, and J. M. Thorne 1986 7 p Presented at the 30th SPIE Technical Symposium on Optics and Optoelectronic Engineering, San Diego, Calif., 17 Aug. 1986
(Contract DE-AS08-84DP-40199)
(DE86-013305; CONF-860880-13) Avail: NTIS HC A02/MF A01

Two-dimensional curved surfaces, which may be suitable for x-ray reflective lenses of the multilayer type, have been produced using polished single crystal (110) silicon wafers. The curvature was achieved using stressed thin films of grown silicon dioxide and deposited silicon nitride. In addition to basic experimental studies with planar structures to determine stress values and predictive equations, the paper describes several methods used for stressing a preferentially etched deep groove silicon structure. The latter structure is needed for noncylindrical surfaces. Effects which limited the predictability and surface quality of the curved surfaces were the thickness variation of the silicon wafers and the occurrence of dislocation slip lines on the polished surface. The latter was primarily due to stress on (111) planes at high temperature. DOE

N87-14984# Brigham Young Univ., Provo, Utah.
DESIGN AND FABRICATION OF HEAT RESISTANT MULTILAYERS
J. M. Thorne, L. V. Knight, B. G. Peterson, R. T. Perkins, and K. J. Gray 1986 7 p Presented at the 30th SPIE Technical Symposium on Optics and Optoelectronic Engineering, San Diego, Calif., 17 Aug. 1986
(Contract DE-AS08-84DP-40199)
(DE86-013306; CONF-860880-12) Avail: NTIS HC A02/MF A01

Many promising applications of multilayer x-ray optical elements subject them to intense radiation. This paper discusses the selection of optimal pairs of materials to resist heat damage and presents simulations of multilayer performance under extreme heat loadings. DOE

N87-14985# Brigham Young Univ., Provo, Utah.
THEORETICAL CONSIDERATIONS IN THE DESIGN OF MULTILAYER X-RAY OPTICS
R. T. Perkins, J. M. Thorne, and H. K. Pew 1986 7 p Presented at the 30th SPIE Technical Symposium on Optics and Optoelectronic Engineering, San Diego, Calif., 17 Aug. 1986
(Contract DE-AS08-84DP-40199)
(DE86-013307; CONF-860880-15) Avail: NTIS HC A02/MF A01

There is increasing interest in the application of multilayers to figured x-ray optics. Two concepts in design appraoch are presented. The requirements for image formation with a multilayer device are discussed. A geometrical approach is used. The possible affect of multilayers on image quality is studied. Models for the reflectivity of x rays by multilayers are compared briefly. DOE

N87-14986# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif. Santa Barbara Operations.
WAVELENGTH-MULTIPLEXED IMAGING TECHNIQUES USING OPTICAL FIBERS
C. E. Iverson, M. A. Nelson, B. R. Marshall, T. J. Davies, and J. W. Ogle 1986 5 p Presented at the 4th International Conference on Optical Fiber Sensors, Tokyo, Japan, 7 Oct. 1986 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contracts W-7405-eng-36; DE-AC08-83NV-10282)
(DE86-013028; EGG-10282-2105; CONF-8610100-1) Avail: NTIS HC A02/MF A01

Wavelength multiplexing techniques provide the basis for many efficient image transmission schemes using optical fibers. A variety of examples is presented and important system characteristics and tradeoffs are considered. DOE

N87-14987# Sira Inst. Ltd., Chislehurst (England). Research and Development Div.
EVALUATION OF LOW DENSITY MIRROR BLANKS FOR SPACE OBSERVATORIES Final Report
A. J. Barker and M. A. Cutter Paris, France ESA Oct. 1985 105 p
(Contract ESTEC-5976/84-NL-PR)
(SIRA-A/7123/00; ESA-CR(P)-2203; ETN-86-98088) Avail: NTIS HC A06/MF A01

Lightweight mirror techniques for space telescopes were identified, and development plans for technology demonstrations were prepared. The basic requirement is for mirrors up to 4 m diameter with area densities of 50 to 100 kg/sqm with aspherical form and a surface accuracy and quality appropriate for the efficient formation of diffraction-limited images with visible radiation. Segmented and membrane mirror systems are more suited to infrared systems. Active thin meniscus mirrors are potentially the most attractive of the techniques reviewed, passive and active. Attractions include the ability to correct gravity release and thermal loads, the wider choice of mirror materials including metals, the reduced dependence on any one mirror manufacturer, the possibility of reducing manufacturing costs, greater design confidence, and the possibility of achieving an area density of 50 kg/sqm. Lightweight fabrication techniques must be developed for the low expansion glasses and glass/ceramics. An alternative approach in which an active deformable mirror is utilized is recommended. This technique could offer great advantages over passive and semipassive techniques and may be applicable to a wider materials range. ESA

N87-14988# Fraunhofer-Inst. fuer Angewandte Festkoerperphysik, Freiburg (West Germany).
LIQUID CRYSTAL MATERIALS AND ELECTROOPTIC EFFECTS FOR HIGH INFORMATION CONTENT DISPLAYS Final Report, Jun. 1985
Guenter Baur, Axel Stieb, Waltraud Fehrenbach, Michael Ganser, Hartmut Grosse, Rudolf Kiefer, Barbara Staudacher, and Friedrich Windscheid Bonn, West Germany Bundesministerium fuer Forschung und Technologie Feb. 1986 99 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-018; ISSN-0340-7608; ETN-86-98193) Avail: NTIS HC A05/MF A01 Fachinformationszentrum, Karlsruhe, West Germany DM 21

Liquid crystals for direct view displays were investigated. Optimized cell and material parameter combinations for electro-optical effects with steep characteristics were evaluated by computer modeling. Storage effects in smectic liquid crystals were improved and tested in sample cells. The influence of molecular structure and short range order on material properties important for liquid crystal displays of high information content was revealed. The degree of order of anthraquinone dyes dissolved in liquid crystals is shown to depend strongly on the molecular structure of the liquid crystal host. Because of their high light stability, anthraquinone dyes are especially suitable for guest host display. ESA

N87-14989# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
INVESTIGATION OF THE OPTICAL PROPERTIES OF SOLAR CELLS Final Report, Dec. 1984
Kurt Bischoff, Heinrich Kaase, and Juergen Metzdorf Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jan. 1986 61 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-86-008; ISSN-0340-7608; ETN-86-98289) Avail: NTIS HC A04/MF A01, Fachinformationszentrum, Karlsruhe, West Germany DM 13

A metrological scale for the AMn weighted spectral responsivity and the efficiency of solar cells was established. The method of differential spectral responsivity was developed. The relative uncertainty is $<2\%$. With integral direct measurements (solar simulator method) comparable results can only be obtained by using a calibrated reference solar cell. In crystalline Si solar cells with p-type base a photoinduced enhancement of the responsivity, increasing with a decrease of the purity of the base material (photoaugmentation) is observed. The measured effective diffusion length of minority carriers in the base is correlated with the photoaugmentation. ESA

N87-14990# AEG-Telefunken, Wedel (West Germany). Fachgebiet Optronik.
PROCESSING OF GRAY-VALUE IMAGE SEQUENCES Final Report, May 1985
Thomas Hockling Bonn, West Germany Bundesministerium fuer Forschung und Technologie Jul. 1986 148 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-86-006; ISSN-0170-9011; ETN-86-98758) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 3

The modification, development, and trials of the industrial image processing system IBS for gray-value and real time image processing are described. Realistic trials of the IBS in a handling system controlled by the evaluation of gray-value image sequences are investigated and the design and application of hardware processors of the IBS are described. For universal application of the IBS, the results of an increased efficiency due to the region border line coding process are described. ESA

N87-14991# Technische Hogeschool, Delft (Netherlands). Lab. voor Technische Natuurkunde.
FURTHER DEVELOPMENTS OF THE SOLID STATE AUTOMATED MICROSCOPE (SSAM) [ONTWIKKELINGEN AAN DE SSAM]
A. L. D. Beckers Dec. 1984 146 p In DUTCH; ENGLISH summary
(ETN-87-98693) Avail: NTIS HC A07/MF A01

Hardware and software developments of the solid state automated microscope (SSAM) were performed in order to integrate the SSAM in pattern recognition equipment. It was necessary to rebuild the system (after moving), to test it, and adapt it. The integration included making connections between computers, and writing software for the HP 1000 and the microcomputers in the SSAM. The user of the HP system can interactively

acquire microscope images. The images can be transported to the HP system using a parallel data link. It is also possible to use the transport processor. The size of a microscope image is 512 x 512 x 8 bits with a spatial resolution of 0.5 microns and a data acquisition speed of 5 Mpixels/sec. Computer programs are enclosed. ESA

N87-14992# European Space Agency, Paris (France).
VISIBILITY OF SIGNAL LIGHTS UNDER ATMOSPHERIC EFFECTS
Gerhard H. Ruppersberg Sep. 1986 68 p Original language document was announced as N86-28742
(ESA-TT-987; DFVLR-FB-85-63; ETN-87-98829) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany 19.50

The influence of atmospheric parameters on the transmission of light was studied. Visual ranges calculated from illuminance thresholds using Allard's law are only valid up to viewing angles of 0.116 mrad. At larger viewing angles neglecting an additional path radiance term results in considerably too high required intensities and too small visual ranges. Chromatical thresholds of luminance or illuminance must contain the path luminance in front of the signal light instead of background luminance. A background stop at small distances considerably reduces the required luminance of a signal light which can also have a negligible influence depending on the dominant type of threshold. ESA

N87-14993# European Space Agency, Paris (France).
SETUP FOR DETERMINING THE REFLECTIVITY OF INTERFERENCE COATINGS
Rolf Gauert and Joachim Bode Aug. 1986 22 p Original language document was announced as N86-32285
(ESA-TT-997; DFVLR-Mitt-85-18; ETN-87-98831) Avail: NTIS HC A02/MF A01; original German version available from DFVLR, Cologne, West Germany DM 11.50

A setup for measuring the reflectivity of evaporated interference coatings of laser mirrors is described. The coatings can be characterized by their reflectivity, which is determined by a compensation method. The setup is calibrated by a mirror of known reflectance. The system can determine the reflectivity with an accuracy of 0.1%. ESA

N87-14994# European Space Agency, Paris (France).
CONSTRUCTION OF FIBER OPTICS TWO-BEAM INTERFEROMETERS AND INVESTIGATIONS OF THE STRAIN AND TEMPERATURE SENSITIVITY
Norbert Fuerstenau Sep. 1986 50 p Original language document was announced as N86-22399
(ESA-TT-980; DFVLR-FB-85-86; ETN-87-98887) Avail: NTIS HC A03/MF A01; original German version available from DFVLR, Cologne, West Germany DM 18

Investigations on fiber optic Mach-Zehnder and Fabry-Perot interferometers are described as a first step in the development of a digital fiber optics control and sensor system. Measurements on laboratory setups yield a digital strain resolution of 0.56 micron/count in agreement with the theoretically derived result. The measured temperature resolution is 0.04 Km/count per 1 m fiber, a value 20% lower as compared to the theoretical one. For automatic fringe counting the Mach-Zehnder setup was modified into a two-polarization type interferometer and its operation was tested by measuring strain and temperature characteristics. ESA

N87-14995# European Space Agency, Paris (France).
MICROPROCESSOR CONTROLLED OPTICAL MEASURING SYSTEM FOR LARGE MIRROR MODULES
Rainer Koehne, Erich Rach, and Franz Reich Sep. 1986 62 p Original language document was announced as N86-28740
(ESA-TT-984; DFVLR-FB-85-58; ETN-87-98889) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, West Germany DM 21.50

A microprocessor controlled contactless measuring system was developed in order to determine how the beam quality of mirrors influences the performance of solar plants with focusing collectors. The system was installed to investigate large flat and curved mirror surfaces (less than or = 10 sqm). An algorithm to evaluate the measured data was derived. The very accurate method is based on laser ray tracing to determine the ripple and the deviations from the ideal contour which can be expressed as a rms value. Measurements on parabolic through mirrors and heliostat segments yield rms values of 10 and 3.7 mrad, respectively. ESA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N87-14996# Danish Space Research Inst., Lyngby.
A NEW METHOD FOR MEASURING SPACE PLASMA CURRENT DENSITIES BY THE FARADAY ROTATION OF LASER LIGHT IN OPTICAL MONOMODE FIBERS
F. Primdahl, P. Hoeg, C. J. Nielsen (Technical Univ. of Denmark, Lyngby.), and J. E. Schroder Sep. 1986 55 p
(Rept-4-86; ISSN-0109-6605) Avail: NTIS HC A04/MF A01

An instrument called a Faraday Ring Magnetometer which is particularly well suited for the measurement of small scale space plasma currents and without the inherent uncertainties of the exisiting methods is discussed. After a brief introduction of the geophysical aspects, the existing methods of space current measurement are compared with the Faraday Ring Magnetometer. The physics of the Faraday Ring Magnetometer are explained, followed by a discussion of the error and noise sources in the system. A brief account of anticipated possibilities for flying the Faraday Ring Magnetometer in space, a budget for a laboratory pilot experiment, and references are presented. B.G.

N87-14997# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTAL EVIDENCE OF MHD SURFACE WAVE
Y. Amagishi Aug. 1986 13 p
(ISSN-0469-4732; IPPJ-786) Avail: NTIS HC A02/MF A01

MHD surface waves of m = - 1 (poloidal number of left-hand rotation) compressional Alfven waves in a cylindrical finite beta plasma have been observed for the first time to propagate together with the shear Alfven waves. The results confirm the recent predictions of the peculiar but interesting properties of the first radial eigenmode of a non-axisymmetric compressional wave in a plasma surrounded by an insulating boundary. Author

N87-14998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASYMPTOTIC ANALYSIS OF CORONA DISCHARGE FROM THIN ELECTRODES
Paul A. Durbin Sep. 1986 7 p
(NASA-TP-2645; E-3151; NAS 1.60:2645) Avail: NTIS HC A02/MF A01 CSCL 20I

The steady discharge of a high-voltage corona is analyzed as a singular perturbation problem. The small parameter is the ratio of the length of the ionization region to the total gap length. By this method, current versus voltage characteristics can be calculated analytically. Author

N87-14999# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
FUNDAMENTAL PROCESSES IN PARTIALLY IONIZED PLASMAS Annual Scientific Report, 1 Feb. 1985 - 31 Jan. 1986
C. H. Kruger, M. Mitchner, and S. A. Self 28 Feb. 1986 82 p
(Grant AF-AFOSR-0108-83)
(AD-A170029; AFOSR-86-0342TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

This research is directed to three major areas: recombination in molecular plasmas, discharge effects (plasma electrode interaction) and interaction of discharges and fluid dynamics. Recombination and ionization are fundamental processes that play a role in nearly all applications and natural phenomena that involve partially ionized plasmas. Under the present program, experiments have

been designed and theoretical analyses conducted to obtain a better knowledge of the rates of electron recombination in the presence of molecular species. Studies are continuing of the near-electrode region and the processes by which current is transferred between the plasmas and the electrodes. The first stage of theoretical modeling of these processes has now been completed and published. A study of the interaction of discharges and fluid dynamics has measured the significant secondary flows caused by the interaction of a magnetic field with a current carrying plasma. Measurements have been made of secondary flows, and of their effects on profiles of axial velocity, turbulence intensity and electrical conductivity. GRA

N87-15000# Tennessee Univ., Knoxville. Science Lab.
INVESTIGATION OF RF EMISSIONS FROM TWO BEAMS INTERACTING WITH AN ELECTRIC FIELD DOMINATED PLASMA Final Report, 15 Mar. 1981 - 14 Mar. 1986
J. R. Roth 15 May 1986 180 p
(Grant AF-AFOSR-0093-81)
(AD-A170043; UTK-PSL-86-1; AFOSR-86-0474TR) Avail: NTIS HC A09/MF A01 CSCL 20/9

This final scientific report summarizes a five year program of experimental research on a steady state, electric field dominated, classical Penning discharge at the University of Tennessee's Plasma Science Laboratory. The objectives of this research program were to study RF emissions and RF interactions with a steady-state, electric field dominated plasma which exhibited instabilities associated with two interpenetrating electron beams. Among the scientific results of this contract are the observation and identification of the geometric mean emission frequency. The RF emissions associated with the geometric mean emission freuency and its harmonics could produce, under some conditions, a virtually flat white noise spectrum from below 0.5 megahertz to frequencies above 1.2 GHz. Quantitative investigations during the latter part of this contract showed that the efficiency of converting the dc electrical power input of the classical Penning discharge into broadband RF radiation was no more than 0.1 or 1.0%. GRA

N87-15001# California Univ., Berkeley. Electronics Research Lab.
NUMERICAL SIMULATIONS OF TURBULENT TRAPPING IN THE WEAK BEAM-PLASMA INSTABILITY
K. Theilhaber, G. Laval, and D. Pesme 5 Jun. 1986 40 p
(Contracts N00014-85-K-0809; DE-FG03-86ER-53220)
(AD-A170108; UCB/ERL-M86/50) Avail: NTIS HC A03/MF A01 CSCL 20/9

Numerical simulations of the weak beam-plasma instability were done in the turbulent regime where small-scale trapping is a dominant feature of the instability, a regime with behavior not predicted by quasilinear theory. It occurs when the trapping frequency nu = cubert (k-sq/d) is larger than the growth rate gamma sub k of the instability. The results of the simulations were compared with those of a specific model of the turbulence, the so-called turbulent trapping model, which gives precise formulas for the particle correlation functions, and predicts a growth rate well enhanced over the quasilinear value. It was found that the model gives accurate predictions for the correlation functions, and thus provides a good description of the turbulent structure of phase space. On the other hand, while growth rates were enhanced over the quasilinear values, the enhancements observed are smaller than expected from the quantitative predictions of the model. Further work is necessary to determine whether this discrepacny is a failing of the turbulent trapping model, or the result of the numerical limitations of our computational scheme. GRA

N87-15002# Universal Energy Systems, Inc., Dayton, Ohio.
METHODS OF PLASMA EXCITATION Final Report, Sep. 1980 - Sep. 1984
J. R. Twist, V. E. Merchant, and M. L. Lake Dec. 1985 154 p
(Contract F33615-80-C-2062)
(AD-A170347; AFWAL-TR-85-2085) Avail: NTIS HC A08/MF A01 CSCL 20/3

This report covers three areas. The first section deals with microwave excitation of small volumes. The work emphasized microwave excitation on mercury bromide. In addition, some discharges were performed in silane gas mixes and in sulphur. The florescence produced by the gas is studied as a function of discharge parameters. The transient conductivity of 1/9 nitrogen/argon gas mixes in pulsed high power atmospheric pressure discharges is studied in the second section. The discharge was produced in a U.V. preionized gas and produced a peak current of about 10 amps per square centimeter. The voltage from a capacitor bank was applied to the discharge electrodes by means of triggered spark gap a set delay after the surface preionizers had fired. Data is presented that shows the transient discharge voltage and current as well as the power dissipated in the gas and the resistivity of the discharge as a function of time. GRA

N87-15003# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
MATERIALS SURFACE MODIFICATION BY PLASMA BOMBARDMENT UNDER SIMULTANEOUS EROSION AND REDEPOSITION CONDITIONS
Y. Hirooka, D. M. Goebel, R. W. Conn, G. A. Campbell, W. K. Leung, K. L. Wilson, W. Bauer, R. A. Causey, D. H. Morse, and J. Bohdansky Jul. 1986 44 p Presented at the Workshop on Surface Modification By Plasma-Surface Interactions, Princeton, N.J., 1 May 1986 Prepared in cooperation with Sandia National Labs., Livermore, Calif. and Max-Planck-Institut fuer Plasmaphysik, Garching, West Germany
(Contract DE-AS03-84ER-52104)
(DE86-014345; UCLA/PPG-992; CONF-860582-1) Avail: NTIS HC A03/MF A01

The first in-depth investigation of surface modification of materials by continuous, high-flux argon plasma bombardment under simultaneous erosion and redeposition conditions have been carried out for copper and 304 stainless steel using the PISCES facility. The plasma bombardment conditions are: incident ion flux range from 10(17th) to 10(19th) ions sec/sq cm, total ion fluence is controlled between 10(19th) to 10(22nd) ions/sq cm, electron temperature range from 5 to 15 eV, and plasma density range from 10(11th) to 10(13th)/cu cm. The incident ion energy is 100 eV. The sample temperature is between 300 and 700K. Under redeposition dominated conditions, the material erosion rate due to the plasma bombardment is significantly smaller (by a factor up to 10) than that can be expected from the classical ion beam sputtering yield data. It is found that surface morphologies of redeposited materials strongly depend on the plasma bombardment condition. The effect of impurities on surface morphology is elucidated in detail. First-order modelings are implemented to interpret the reduced erosion rate and the surface evolution. Also, fusion related surface properties of redeposited materials such as hydrogen reemission and plasma driven permeation have been characterized. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N87-15004*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LIQUID ENCAPSULATED FLOAT ZONE PROCESS AND APPARATUS Patent Application
Robert J. Naumann, Donald O. Frazier, Sandor L. Lehoczky, Marcus Vlasse, and Barbara R. Facemire, inventors (to NASA) Filed 29 Oct. 1986 15 p
(NASA-Case-MFS-28144-1; NAS 1.71:MFS-28144-1; US-Patent-Appl-SN-924399) Avail: NTIS HC A02/MF A01 CSCL 46D

Process and apparatus for growing crystals using float zone techniques are described. A rod of crystalline materials is disposed

in a cylindrical container, with a space being left between the rod and container walls. The space is filled with an encapsulant, selected to have a slightly lower melting point than the crystalline material. The rod is secured to a container end cap at one end and to a shaft at its other end. A piston slides over the rod and provides pressure to prevent loss of volatile components upon melting of the rod. Prior to melting the rod the container is first heated to melt the encapsulant, with any off-gas from this step being vented to a cavity behind the piston. The piston moves slightly forward owing to volume change upon melting of the encapsulant, and the vent pasageway is closed. The container is then moved longitudinally through a heated zone to progressively melt sections of the rod as in conventional float zone processes. The float zone technique may be used in the microgravity environment of space. NASA

N87-15005# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
Pb(1-x) Sn(x)Te PHOTOVOLTAIC DETECTORS AND SEMICONDUCTOR LASERS FABRICATED BY LIQUID PHASE EXPITAXY [DETETORES FOTOVOLTAICOS E LASERS SEMICONDUTORES DE PB1-XSN(X)TE FABRICADOS POR EPITAXIA A PARTIR DA FASE LIQUIDA]
Sukarno O. Ferreira, E. Abramof, Marcos D. Silva, and I. N. Bandeira Sep. 1986 24 p In PORTUGUESE Submitted for publication
(INPE-3992-PRE/992) Avail: NTIS HC A02/MF A01

Various phases of the liquid phase epitaxial (LPE) growth process are related for fabrication of Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers operative in the infrared range. An LPE system and techniques used for formation of p-n junctions are described, and the characteristic morphology of the epitaxial coatings obtained are explained. Fabricated detectors and lasers show detectivity to 10 to the 9th power to 10 to the 11th power cm/Hz (sup1/2)/W and current threshold of 2.5 kA/sq cm, when operating at 80K. Author

N87-15006# National Bureau of Standards, Gaithersburg, Md.
REPORT ON AN INTERLABORATORY ELECTROMIGRATION EXPERIMENT
Harry Schafft, Tammy Grant, John Mandel, and John Shott (Stanford Univ., Calif.) Jun. 1986 12 p
(Contract DARPA Order 3882)
(AD-A169652) Avail: NTIS HC A02/MF A01 CSCL 20/12

Electromigration is a metallization failure mechanism that is of concern for Very Large Scale Integration reliability. Ambiguities exist in the electromigration characterization of metallizations. These ambiguities are, in general, due to the different test structures and measurement methods used and to the incomplete reporting of the results from such characterizations. An interlaboratory experiment has been organized to address this problem. The purpose of the experiment is to assess the reproducibility of electromigration characterizations and to establish the technical base needed to develop guidelines for the design of electromigration test structures, for methods to measure the median time to failure of metallizations, and for reporting characterization measurements. GRA

N87-15007# Westinghouse Research and Development Center, Pittsburgh, Pa.
HIGH SPECIFIC HEAT DIELECTRICS AND KAPITZA RESISTANCE AT DIELECTRIC BOUNDARIES Annual Report, 1 Aug. 1983 - 30 Sep. 1985
P. W. Eckels, W. N. Lawless, J. H. Parker, Jr., B. R. Patton, and C. F. Clark 30 Sep. 1985 417 p
(Contract F49620-83-C-0129)
(AD-A169964; AFOSR-86-0477TR) Avail: NTIS HC A18/MF A01 CSCL 20/13

This program has two efforts: Kapitza and thermal properties studies. Two separate Kapitza conductance test facilities have been designed and fabricated for both solid solid and for solid liquid HE II measurements. Preliminary data has been obtained for copper to T lambda C lambda interface conductance and also for KBr and LiF thermal conductance to Helium II. For the latter two materials, the test dewars were designed to allow cleaving of the samples under liquid helium. The Kapitza conductance of both samples was very near the phonon radiation limit providing strong evidence that the anomalous Kapitza conductance is not the result of surface contamination. Thermal properties work has included the measurement of the specific heat and thermal conductivity of the CdCr2O4 spinels and of several CsC lambda structure heavy metal halides in the temperature range of 1.5 to 35K. The specific heat data for the spinels was analyzed in terms of both lattice phonons and magnetic contributions. The dependence of the spinel's thermal conductivity on magnetic fields up to 15T was studied and magnetocaloric data has been obtained. For both the Zn and Cd spinels, the lattter results showed a paramagnetic behavior with demagnetization cooling and magnetization heating. Theory has been developed to explain some of the magnetocaloric effects in the new spinels, CdCr2O4 and ZnCr-2O4. GRA

N87-15008# Massachusetts Inst. of Tech., Cambridge. Materials Processing Center.
GROWTH OF CADMIUM TELLURIDE UNDER CONTROLLED HEAT TRANSFER CONDITIONS Final Report, 15 May 1982 - 30 Aug. 1985
August F. Witt 11 Jun. 1986 42 p
(Contract DAAG29-82-K-0119)
(AD-A170031; ARO-18562.1-MS) Avail: NTIS HC A03/MF A01 CSCL 20/2

The thrust of this research project was directed at the development of new approaches leading to growth of CdTe single crystals with improved crystalline and chemical perfection. In pursuit of this objective a theoretical analysis was made of the stability of the growth interface as a function of crystallographic orientation. Using the concept of dangling bond densities, it was found that experimentally observed solitary and lamellar twinning phenomena during growth can be directly related to anisotropy in the energetics of unavoidably curved crystal melt interfaces. The theoretical results obtained led to the development of a vertical Bridgman growth configuration in which heat transfer control is accomplished through an axially aligned heat exchange system comprising a heat pipe, a gradient control zone, and a heat levelling device. As an alternate approach to melt growth of CdTe, the suitability of the high pressure liquid encapsulation Czochralski technique (HP-LEC) was investigated. In the course of this study, analytical techniques, including IR transmission microscopy with image processing and absorption spectroscopy of the optical band edge, were developed and applied to investigations of the bulk defect structure. The results obtained during this research program constitute the basis for extensive DARPA, Air Force, and NASA sponsored research on growth of III-V and II-VI compound semiconductor systems. GRA

N87-15009# California Univ., Los Angeles.
NOVEL SI-BASED MATERIALS AND DEVICE STRUCTURES BY MOLECULAR BEAM EPITAXY Final Report, 25 Apr. 1983 - 24 Apr. 1986
Kang L. Wang 15 Jun. 1986 29 p
(Contract DAAG29-83-K-0070)
(AD-A170061; ARO-19677.14-EL) Avail: NTIS HC A03/MF A01 CSCL 20/12

The final report describes the technical tasks and accomplishments during the contractual period from April 25, 1983 to April 24, 1986. Research findings in four scientific areas, (1) MBE growth, (2) heterojunction properties, (3) superlattice and quantum well structural devices, and (4) Si on insulator by MBE are summarized. Details of these results are referred to in the journal publications attached. GRA

N87-15010# California Univ., Santa Barbara. Dept. of Electrical and Computer Engineering.
DEVELOPMENT OF A PLANAR HETEROJUNCTION BIPOLAR TRANSISTOR FOR VERY HIGH SPEED LOGIC Annual Technical Report, 1 Oct. 1984 - 1 Mar. 1986
Stephen I. Long, Herbert Kroemer, and M. A. Rao 28 Mar. 1986

55 p
(Grant AF-AFOSR-0344-82)
(AD-A170063; AFOSR-86-0487TR; ATR-3) Avail: NTIS HC A04/MF A01 CSCL 20/12

The following report describes the results of research on III-V molecular beam epitaxial (MBE) growth, material characterization and the fabrication of heterostructure bipolar transistors (HBT) for very high speed logic applications. During the reporting period work on the InGaP/GaAs heterojunction (HJ) was completed. Isotype HJs were grown and evaluated by a CV reconstruction method in order to determine the energy band offsets. It was found that Ec=0.21 eV and Ev=0.25 eV for the lattice matched composition. A new direction toward improvement in performance and the fabrication techniques for the AlGaAs/GaAs HBT was successfully demonstrated. Graded-bandgap nonalloyed ohmic contacts using n+ InAs and GaAs for the AlGaAs emitter and p+ GaSb for the GaAs base were provided by selective epitaxial regrowth. The MBE growth conditions for grading from GaAs to InAs to GaSb were determined. Low specific contact resistances were observed for both contact types. A AlGaAs/GaAs graded-gap contact HBT was grown. A current gain of 20 was measured with only simple wire probes on the base and emitter. GRA

N87-15011# Texas Univ., Austin. Electrical Engineering Research Lab.
LARGE SIGNAL MODELING AND ANALYSIS OF THE GaAs MESFET Technical Report, for Period Ending 1 Jun. 1986
Vincent D. Hwang and Tatsuo Itoh 9 Jul. 1986 60 p
(Contract DAAG29-84-K-0076)
(AD-A170304; TR-86-P-2; ARO-21438.27-EL) Avail: NTIS HC A04/MF A01 CSCL 09/1

The purpose of this work is to develop a large signal lumped circuit model of the GaAs MESFET to aid in the designs of microwave MESFET circuits. The circuit elements of this model are obtained either directly or indirectly from the DC and RF measurements of the device to be modeled. To analyze this circuit model, a nonlinear circuit simulation computer program is written. This routine is base on a hybrid time-frequency domain iterative algorithm called multiple reflection technique. To improve the speed of analysis, an accelerate convergence scheme is incorporated into the multiple reflection technique for the first time to analyze three terminal device. The validity of the analysis algorithm is first checked by comparing the simulation results of a MESFET with published data. The large signal model developed is then confirmed by comparing the simulation results of a MESFET modeled in this work to the experimental results. Author (GRA)

N87-15012# Colorado State Univ., Fort Collins.
CARBON WHISKER STUDY Final Report, 1 Mar. 1984 - 28 Feb. 1986
Spain, Ian 11 Jun. 1986 58 p
(Contract F49620-84-K-0006)
(AD-A170345; AFOSR-86-0660TR) Avail: NTIS HC A04/MF A01 CSCL 20/2

Preliminary work was carried out on the preparation of filaments prepared by ion bombardment of carbon surfaces. The effects of ion energy, ion dose (time), substrate temperature, type of substrate carbon, and the presence of Fe catalyst were investigated. Models for growth were developed at both CSU and IBM. GRA

N87-15013# Brown Univ., Providence, R. I. Div. of Engineering.
PICOSECOND NONLINEAR RESONANT INTERACTIONS IN SEMICONDUCTORS Annual Report, 1 Jan. - 31 Dec. 1985
Arto V. Nurmikko Mar. 1986 26 p
(Contract F49620-82-C-0044)
(AD-A170860; AFOSR-86-0529TR; AR-4) Avail: NTIS HC A03/MF A01 CSCL 20/12

This research was aimed at advancing understanding and utilization of selected optical properties of semiconductors containing magnetic elements. Emphasis was placed on the interaction of such materials with ultrashort pulses of laser radiation in order to study coupled electronic and magnetic excitations under selected nonequilibrium conditions. We hoped to generate novel results through experimental research for applications to fast optoelectronic devices. The mixed crystal semiconductors (Cd, Mn)Se and (Cd, Mn)Te were used. The contract work has generated a number of firsts, e.g., we measured the formation of local, microscopic magnetically oriented domains through real-time spectroscopy with picosecond laser pulses. Author (GRA)

N87-15014# International Centre for Theoretical Physics, Trieste (Italy).
POLARIZABILITY OF A CRYSTAL WITH IMPURITIES
S. Goettig Sep. 1985 17 p
(DE86-702900; IC-85/196) Avail: NTIS (US Sales Only) HC A02/MF A01

The expression for the complex frequency- and wavevector-dependent longitudinal electronic polarizability due to the presence of a weak static disorder (e.g., impurities) in a crystal with an arbitrary band structure is derived. The quantum kinetic equation in the self-consistent-field approximation is solved, expanding the one-particle density operator in powers of the screened static imperfection field and a weak perturbing electric field. The polarizability is determined by the induced electronic charge density quadratic in the imperfection field and linear in the perturbing field, averaged over the statistical distribution of imperfections. The obtained expression, which accounts properly for the collective effects in the electronic plasma, takes also into account the polar coupling of the plasma with longitudinal optical phonons. The conductivity in the optical limit (vector q yields 0) is calculated, and the correspondence with one-band effective-mass approximation is established. DOE

N87-15015# International Centre for Theoretical Physics, Trieste (Italy).
STARK LADDER DENSITY OF STATES IN A FINITE CRYSTAL
F. Claro and M. Pacheco Sep. 1985 12 p
(DE86-702906; IC-85/226) Avail: NTIS (US Sales Only) HC A02/MF A01

We show that the density of states for an electron in a finite periodic lattice and an external electric field has a background of states proportional to Esup(d/2), where E and d are the energy and dimensionality of the system, respectively. This background is modulated by an asymptotically periodic structure with the Stark period that involves a fraction of order Esup(-d/2) of the total number of states in each period. The structure is more pronounced in lower dimensionality systems. Numerical results are included for a superlattice with a sawtooth potential. DOE

N87-15016# Dow Corning Corp., Midland, Mich.
NOVEL SILANE AND DISILANE PRECURSORS TO AMORPHOUS SEMICONDUCTORS Annual Report, 1 Apr. 1985 - 31 Mar. 1986
U. Pernisz and K. Sharp Aug. 1986 35 p
(Contract DE-AC02-83CH-10093)
(DE86-010734; SERI/STR-211-2997) Avail: NTIS HC A03/MF A01

This report describes the preparation and characterization of amorphous fluorohydrogenated silicon thin films. The novel approach lies in the use of fluorinated silanes as film precursors. This method has the advantages of well-defined initial ratios of hydrogen and fluorine and a greatly reduced hazards in the handling of the gas. Fluorine derivatives of both silane and disilane were synthesized. A conventional method, glow discharge (or plasma-enhanced chemical vapor deposition), was employed to prepare amorphous silicon on glass and Si wafers. The electrical characterization of the material prepared from difluorosilane (the main precursor during the contract period covered in this report) showed that the a-Si:H:F films obtained are of solar-grade semiconductor quality and can be doped to p- and n-type material with diborane and phosphine. DOE

N87-15017# Sandia National Labs., Albuquerque, N. Mex.
SURVEY OF MATERIALS AND DEVICE TECHNOLOGIES FOR HIGH-TEMPERATURE (T<300C) POWER SEMICONDUCTOR ELECTRONICS

T. E. Zipperian Sep. 1986 14 p Presented at the Intertec Communications Incorporated Conference, Boston, Mass., 27 Oct. 1986
(Contract DE-AC04-76DP-00789)
(DE86-015822; SAND-86-2151C; CONF-8610142-1) Avail: NTIS HC A02/MF A01

Recent advances in solid-state materials and device technologies are reviewed as they relate to power semiconductor electronics functioning at temperatures in excess of 300°C. The problems faced by semiconductor structures operating in this temperature range are described and six compound semiconductor materials systems capable of improved high-temperature device function, when compared to silicon technologies, are detailed and critiqued. In this light, a number of prototype junction devices including diodes, bipolar junction transistors, and semiconductor controlled rectifiers are described which have demonstrated useful electrical characteristics to temperatures as high as 550°C. In conclusion, the major reliability concerns associated with high-temperature operation are addressed and potential solutions described. DOE

N87-15018# Sandia National Labs., Albuquerque, N. Mex.
HOLE TRANSPORT AND CHARGE TRANSFER IN GaAs/InGaAs GaAs SINGLE STRAINED QUANTUM WELL STRUCTURES
I. J. Fritz, J. E. Schirber, E. D. Jones, T. J. Drummond, and G. C. Osbourn 1986 14 p Presented at the International Symposium on Gallium Arsenide and Related Compounds, Las Vegas, Nev., 28 Sep. 1986
(Contract DE-AC04-76DP-00789)
(DE86-016098; SAND-86-2094C; CONF-8609150-1) Avail: NTIS HC A02/MF A01

Reported are studies of MBE-grown single strained quantum well structures with In sub 0.2 Ga sub 0.8/As wells and GaAs barriers. Structures with selective p-type doping were investigated using Hall-effect, magnetoresistance and magnetoluminescence measurements. Measured carrier densities were fit to a simple charge-transfer model. Directly measured effective masses confirm the prediction of a strain-induced, density-dependent light hole mass for planar conduction. Mobilities comparable to electron mobilities were attainted. DOE

N87-15019# Ecole Nationale Superieure des Telecommunications, Paris (France). Lab. Modelisation-Caracterisation.
DISTRIBUTED CHARGE MODEL MOS TRANSISTORS Thesis [MODELE A CHARGES DISTRIBUEES (MCD) DU TRANSISTOR MOS]
Jean-Jacques Charlot Mar. 1986 47 p In FRENCH
(ENST-86D003; ISSN-0751-1345; ETN-86-98584) Avail: NTIS HC A03/MF A01

A model of MOS transistors was improved to obtain an accurate representation to simulate all types of loadings. The channel zone is decomposed in small cells to approximate a distributed charge. The surface potential is integrated along the channel. The model simulations are compared to experimental results, mainly in the less than 1 micron size. The experimental values confirm the validity of the model. ESA

N87-15020# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
VERIFICATION AND MODIFICATION OF THE dc MOS-TRANSITOR MODEL OF POORTER Thesis [VERIFICATIE EN MODIFICATIE VAN HET DC MOS-TRANSISTOR MODEL VAN POORTER]
J. J. A. Feiken 1984 81 p In DUTCH
(E-EEA/323/10/1984; ETN-86-98716) Avail: NTIS HC A05/MF A01

Modifications of the Poorter model for network analysis programs to describe modern MOS-transistors are discussed. The modified model is described by seven parameters each of which can be related to a certain physical phenomenon in the MOS transistor. The model parameters are determined by nonlinear optimization methods using the Marquardt algorithm. The parameters allow the calculation of the transistor characteristics. Comparison with measurements shows that the modified Poorter model describes some characteristics very accurately (2% to 3%); others are described with deviations as large as between 50% and 400%. ESA

N87-15021# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
CALCULATION OF ACTIVATION ENERGIES FOR DEFECT MOVEMENT DURING COINCIDENCE BOUNDARY MIGRATION IN NICKEL OXIDE USING COMPUTER SIMULATION TECHNIQUES
H. V. Atkinson and D. M. Duffy Dec. 1985 32 p
(AERE-R-11909) Avail: NTIS HC A03/MF A01

Two possible atomistic mechanisms of grain boundary migration in nickel oxide have been examined for two coincidence boundaries using computer simulation techniques. In mechanism 1, the boundary migrated as the result of anion vacancy diffusion across the boundary with a calculated activation energy of 0.64 eV in a (211)/(011) boundary. In mechanism 2, ions migrated across the boundary to add onto the opposite crystal lattice without the need for vacancies. This mechanism had an actrivation energy of 0.78 eV in a (122)/(011) boundary and was controlled by cation migration. Values for the activation energy for grain growth were deduced from experimental data for NiO. These values are for real material with uncontrolled grain boundary types rather than theoretical material containing only a coincidence boundary. Comparison between the experimental and the predicted activation energies suggests that, unless the effective anion vacancy formation energy at a general grain boundary is very much less than expected, it would seem likely that anion vacancy formation is not required for boundary migration. Author

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N87-15022 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
A REVIEW OF METHODS OF PERSONAL IDENTITY VERIFICATION
W. L. Price Jul. 1986 18 p
(NPL-DITC-73/86; ISSN-0262-5369; ETN-86-98614) Copyright. Avail: Issuing Activity

Methods of personal identity verification for control of access to data resources of value are reviewed. Methods using tokens and/or passwords, and biometric methods are discussed. ESA

N87-15023# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
DOD (DEPARTMENT OF DEFENSE) ACQUISITION: CASE STUDY OF THE AIR FORCE SPACE BASED SPACE SURVEILLANCE SYSTEM
Jul. 1986 13 p
(PB86-230620; GAO/NSIAD-86-45S-17) Avail: NTIS HC A02/MF A01 CSCL 15D

The study of the Space Based Space Surveillance Program focuses on the role of the program manager and contracting officer in developing an acquisition strategy. GRA

N87-15024# Leadership and Management Development Center, Maxwell AFB, Ala.
COMPENDIUM OF RESEARCH Final Report
31 Jul. 1986 52 p
(AD-A170356; LMDC-TR-86-1) Avail: NTIS HC A04/MF A01 CSCL 05/1

The Directorate of Research and Analysis was active between 1980 and 1986 in performing organizational research, documenting and publishing results, and in advising selected Air Force professional military education and degree-seeking students in research using LMDC resources and materials. The compendium presentation of those documents is divided into three parts. The first is Reseach Program Descriptions. In this section, the programs producing published documents are briefly discussed and ordering information provided. The second section contains abstracts of LMDC/AN technical reports available through the Defense Technical Information Center (DTIC). Also included for each of these reports are its security classification, LMDC report number and date, author(s) or editor(s), distribution statement, and key words. The third section is LMDC/AN Research Publication. Here, the actual documents themselves are listed including author, title, and publication date, if appropriate. This third section, in turn, contains several subsections as reflected in the Table of Contents. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N87-15025# Ohio State Univ., Columbus.
DISTRIBUTED KNOWLEDGE BASE SYSTEMS FOR DIAGNOSIS AND INFORMATION RETRIEVAL Annual Report, 1 Jul. 1984 - 30 Jun. 1985
B. Chandrasekaran Sep. 1985 104 p
(Grant AF-AFOSR-0255-82)
(AD-A170830; AFOSR-86-0509TR) Avail: NTIS HC A06/MF A01 CSCL 09/4

During the year, progress was made in our research on distributed approaches to knowledge-based problem-solving in the following areas: (1)We have developed an approach called consolidation to reason qualitatively about the behavior of systems of components. This approach and the more classical approach of qualitative simulation are complementary; (2)We have made further progress in developing an architectural framework for diagnostic reasoning; (3)We have elucidated some of the criteria that govern how design plans are selected for further refinement in design problem solving; (4)We have identified a number of generic tasks into which the information processing activity of most of the expert systems can be decomposed. These generic tasks are at a much higher level of abstraction, and this should make knowledge acquisition and explanation for expert systems easier; (5)We have clarified how symbolic qualitative knowledge-based processing helps when problems get complex by considering the concrete task of classification. We compare the pattern recognition and artificial intelligence approaches to the problem. Author (GRA)

N87-15026# Texas A&M Univ., College Station. Dept. of Management.
ORGANIZATIONS AS INFORMATION PROCESSING SYSTEMS Final Technical Report
Richard Daft and Ricky Griffin Oct. 1986 17 p Sponsored by the Department of the Navy
(AD-A173362) Avail: NTIS HC A02/MF A01 CSCL 05/2

This Final Technical Report describes the three year research effort on Organizations as Information Processing Systems. The original proposal written in 1982 delineated four objectives for the research project. These included: (1) Develop and empirically evaluate a framework of the information processing behavior of managers; (2) Develop and empirically evaluate a framework of the role of information as a source of social influence for organizational leaders; (3) Develop and empirically evaluate a framework describing organizations as interpretation systems; and (4) Suggest policy and practice implications for the more effective management of information processing systems in and between organizations. The first three objectives tied directly to the three subprojects proposed as the major focus of the research: manager information processing behavior, information as social influence, and organizations as an interpretive system. The final objective was more global. In all three areas researched, suggestions about improving the management of information processing systems in and between organizations were to be made. GRA

N87-15027# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
ON DELIBERATE MISREFERENCING AS A TOOL OF SCIENCE POLICY
F. Hoyle and N. C. Wickramasinghe 1 Jun. 1986 3 p Submitted for publication
(Preprint-125; ETN-86-98364) Avail: NTIS HC A02/MF A01

It is claimed that the magazine Nature misreferences articles by Hoyle et al because of their opposition to Darwin's theory of evolution. ESA

N87-14252# National Aerospace Lab., Tokyo (Japan).
ON A DATA BASE SYSTEM FOR NUMERICAL SIMULATOR
Tadao Ishizuka, Hajime Miyoshi, and Takayuki Aki *In its* Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics Nov. 1985 p 33-41 In JAPANESE; ENGLISH summary (For primary document see N87-14247 06-02)
Avail: NTIS HC A12/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N87-15028# Committee on Commerce, Science, and Transportation (U. S. Senate).
REPORT OF THE NATIONAL COMMISSION ON SPACE
Washington GPO 1986 53 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 99th Congress, 2nd Session, 22 Jul. 1986

(S-Hrg-99-954; GPO-64-727) Avail: Subcommittee on Science, Technology and Space

The proposed agenda for the civilian space program for the next 20 years and beyond was discussed. The National Commission on Space proposed a broad, long-range, pioneering mission which includes: exploration and development of the space frontier; advancing science, technology, and enterprise; and building institutions and systems that make acessible vast resources and support human settlement beyond Earth orbit, from the highlands of the Moon to the plains of Mars. To accomplish this mission, three mutually-supportive thrusts are outlined: advancing scientific understanding of the planet Earth, the solar system, and the universe; exploring, prospecting, and settling the solar system; and stimulating space enterprise. B.G.

N87-15029# Lawrence Livermore National Lab., Calif.
STRATEGIC DEFENSE INITIATIVE AND THE PROSPECTS FOR INTERNATIONAL COOPERATION IN SPACE
L. L. Wood 1986 17 p Presented at the 29th Seminar for Diplomats, Klessheim, Austria, 5 Aug. 1986
(Contract W-7405-eng-48)
(DE86-016153; UCRL-95022; CONF-8608118-1) Avail: NTIS HC A02/MF A01

While the nature of international cooperation in space is for politicians and diplomats to determine, the prospects for such cooperation have technical and economic bounds upon them. What these bounds are and how the Strategic Defense Initiative of the Western Alliance may impact them will be discussed. It is concluded that the SDI, due to its institutional youthfulness, its charter for large-scale research and its de facto monopoly on such activity, is likely to dominate the technical aspects of the prospects for cooperation in space for the next quarter-century, especially if it continues more-or-less as the current American Administration contemplates. Both the technical and the economic aspects of international cooperation in space are likely to be substantially enhanced due to the existence of the SDI. DOE

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N87-15030*# Garrett Turbine Engine Co., Phoenix, Ariz.
BRAYTON CYCLE SOLARIZED ADVANCED GAS TURBINE Final Report, Feb. 1980 - Mar. 1986
Dec. 1986 135 p
(Contract DEN3-181)
(NASA-CR-179559; DOE/NASA-0181; NAS 1.26:179559; Garrett-31-6190) Avail: NTIS HC A07/MF A01 CSCL 10B

Described is the development of a Brayton Engine/Generator Set for solar thermal to electrical power conversion, authorized under DOE/NASA Contract DEN3-181. The objective was to design, fabricate, assemble, and test a small, hybrid, 20-kW Brayton-engine-powered generator set. The latter, called a power conversion assembly (PCA), is designed to operate with solar energy obtained from a parobolic dish concentrator, 11 meters in diameter, or with fossil energy supplied by burning fuels in a combustor, or by a combination of both (hybrid model). The CPA consists of the Brayton cycle engine, a solar collector, a belt-driven 20-kW generator, and the necessary control systems for automatic operation in solar-only, fuel-only, and hybrid modes to supply electrical power to a utility grid. The original configuration of the generator set used the GTEC Model GTP36-51 gas turbine engine for the PCA prime mover. However, subsequent development of the GTEC Model AGT101 led to its selection as the powersource for the PCA. Performance characteristics of the latter, thermally coupled to a solar collector for operation in the solar mode, are presented. The PCA was successfully demonstrated in the fuel-only mode at the GTEC Phoenix, Arizona, facilities prior to its shipment to Sandia National Laboratory in Albuquerque, New Mexico, for installation and testing on a test bed concentractor (parabolic dish). Considerations relative to Brayton-engine development using the all-ceramic AGT101 when it becomes available, which would satisfy the DOE heat engine efficiency goal of 35 to 41 percent, are also discussed in the report. Author

N87-15031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED STIRLING CONVERSION SYSTEMS FOR TERRESTRIAL APPLICATIONS Final Report
Richard K. Shaltens 1987 26 p To be presented at the Solar Energy Conference, Honolulu, Hawaii, 22-27 Mar. 1987; cosponsored by ASME, JSME and JSES
(Contract DE-AT04-85AL-33408)
(NASA-TM-88897; E-3314; DOE/NASA-33408/1; NAS 1.15:88897) Avail: NTIS HC A03/MF A01 CSCL 10B

Under the Department of Energy's (DOE) Solar Thermal Technology Program, Sandia National Laboratories (SNLA) is developing heat engines for terrestrial Solar Distributed Heat Receivers. SNLA has identified the Stirling to be one of the most promising candidates for the terrestrial applications. The free-piston Stirling engine (FPSE) has the potential to meet the DOE goals for both performance and cost. The National Aeronautics and Space Administration (NASA) Lewis Research Center (LeRC) is conducting free-piston Stirling activities which are directed toward a dynamic power source for space applications. Space power system requirements include high efficiency, very long life, high reliability and low vibration. The FPSE has the potential for future high power space conversion systems, either solar or nuclear. Generic free-piston technology is currently being developed by LeRC for DOE/ORNL for use with a residential heat pump under an Interagency Agreement. Since 1983, the SP-100 Program (DOD/NASA/DOE) is developing dynamic power sources for space. Although both applications (heat pump and space power) appear to be quite different, their requirements complement each other. A cooperative Interagency Agreement (IAA) was signed in 1985 with NASA Lewis to provide technical management for an Advanced Stirling Conversion System (ASCS) for SNLA. Conceptual design(s) using a free-piston Stirling (FPSE), and a heat pipe will be discussed. The ASCS will be designed using technology which can reasonably be expected to be available in the 1980's. Author

N87-15032# Office of Naval Research Liason Office, Far East, APO, San Francisco, Calif.
ONR FAR EAST SCIENTIFIC BULLETIN, VOLUME 11, NUMBER 2 Report, Apr. - Jun. 1986
George B. Wright and Mary L. Moore Jun. 1986 146 p
(AD-A172479) Avail: NTIS HC A07/MF A01 CSCL 05/2

This quarterly publication presents articles covering recent developments in Far Eastern (particularly Japanese) scientific research. Partial Contents of this issue: Japanese Accomplishments in MOCVD Growth of III-V Compound Semiconductors; Research Programs in the Japanese Meteorological Research Inst., The Univ. of Tokyo Ocean Research Inst.; The Philippine Council for Agriculture and Resources Research and Development; Optoelectronics in the People's Republic of China; Present and Future Synchrotron Radiation Facilities in Japan; High Precision Frequency Standards in Japan; Measurement and Instrumentation Systems Center Established in Australia; Government-sponsored Research in Industry through the Japan Key Technology Center; English-Language Information Sources; Japan's Fine Ceramics Center; International Meetings in the Far East, 1986-1990. GRA

N87-15033# Massachusetts Inst. of Tech., Cambridge. Dept. of Computer and Information Science.
DYNAMIC IMAGE INTERPRETATION FOR AUTONOMOUS VEHICLE NAVIGATION Annual Report, 26 Feb. 1985 - 25 Feb. 1986
Edward M. Riseman and Allen R. Hanson Sep. 1986 19 p

(Contract DACA76-85-C-0008)
(AD-A173209; ETL-0437) Avail: NTIS HC A02/MF A01 CSCL 09/4

The contractor's Autonomous Land Vehicle Project has been concerned with a variety of problems associated with sensor motion analysis and dynamic image interpretation of autonomous navigation. Long-range research goals include: (1) Determine the motion parameters of a senor relative to the static environment; (2) Distinguish moving objects from the static environment and determine their motion parameters; (3) Develop algorithms for tracking and predicting the motion and environmental location of the sensor and moving objects; (4) Build a reliable depth map of the environment from combined motion, stereo, and laser range data; (5) Identify major objects (both static and moving) in the environment while the sensor is either stationary or in motion; (6) Interpretation of the environment (i.e., object identification in road scenes) to provide constraints for identifying and tracking moving objects; (7) Provide information to update an environmental model of the moving sensor, including location of the sensor, other moving objects and distinguished stationary objects; (8) Provide control information to an expert navigational and spatial-reasoning system for the purposes of path planning and obstacle avoidance; (9) Integrate all of the above capabilities into a flexible and extensible system for dynamic scene interpretation. GRA

88 SPACE SCIENCES (GENERAL)

N87-15034*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH AND TECHNOLOGY, FISCAL YEAR 1986, MARSHALL SPACE FLIGHT CENTER Annual Report
Nov. 1986 138 p
(NASA-TM-86567; NAS 1.15:86567) Avail: NTIS HC A07/MF A01 CSCL 05A

The Marshall Space Flight Center is continuing its vigorous efforts in space-related research and technology. Extensive activities in advanced studies have led to the approval of the Orbital Maneuvering Vehicle as a new start. Significant progress was made in definition studies of liquid rocket engine systems for future space transportation needs and the conceptualization of advanced laucnch vehicles. The space systems definition studies have brought the Advanced X-ray Astrophysics Facility and Gravity Probe-B to a high degree of maturity. Both are ready for project implementation. Also discussed include significant advances in low gravity sciences, solar terrestrial physics, high energy astrophysics, atmospheric sciences, propulsion systems, and on the critical element of the Space Shuttle Main Engine in particular. The goals of improving the productivity of high-cost repetitive operations on reusable transportation systems, and extending the useful life of such systems are examined. The research and technology highlighted provides a foundation for progress on the Hubble Space Telescope, the Space Station, all elements of the Space Transportation System, and the many other projects assigned to this Center. Author

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N87-15035*# Ohio State Univ., Columbus. Dept. of Astronomy.
EMISSION LINE REGION KINEMATICS IN SELECTED SEYFERT GALAXIES Final Report, 1 Jul. 1985 - 30 Jun. 1986
Gary J. Ferland Jan. 1987 4 p
(Grant NAG5-573; RF Proj. 764809/717357)
(NASA-CR-180029; NAS 1.26:180029) Avail: NTIS HC A02/MF A01 CSCL 03A

The kinematic state of the emission line regions of active galactic nuclei (AGN) is a fundamental problem which addresses the very nature of these objects. The currently popular model of the energy source of the latter is accretion onto the supermassive black hole which is believed to reside in the nuclear regions of galaxies. If this picture is correct then the emission line gas may be expected to be infalling, and may eventually provide the fuel to power them. It is very difficult to determine the kinematic state of the emission line gas because of the technical problems associated with their small apparent sizes, as seen from the earth. One can only observe the net emission from a large ensemble of clouds, so the emission lines are by necessity composite. Several very long exposures of NGC 1068, one of the very nearest Seyfert galaxies, were obtained. Because of its proximity, it is expected to have the best resolved emission line regions as seen from earth. The La emission line of neutral hydrogen will radiate preferentially in the direction of the central object because of the effects of emission line gas opacity on the transfer of radiation out of the clouds. By obtaining high dispersion observations of Doppler broadening of the line through the small entrance aperture of the IUE one can determine whether this material is in a state of outflow (expected if explosions power the central engine), inflow (expected for accretion onto a massive black hole), or rotation (expected for gas with significant angular momentum near the central regions of a galaxy). Author

N87-15036# Smithsonian Astrophysical Observatory, Cambridge, Mass.
HIGH RESOLUTION ASTROPHYSICAL OBSERVATIONS USING SPECKLE IMAGING Final Report, 1 Jan. 1981 - 31 Dec. 1985
Robert W. Noyes, Peter Nisenson, Costas Papaliolios, and Robert V. Stachnik 11 Apr. 1986 105 p
(Grant AF-AFOSR-0055-81)
(AD-A170430; AFOSR-86-0427TR) Avail: NTIS HC A06/MF A01 CSCL 03/1

This report describes progress under a contract to develop a complete astronomical speckle image reconstruction facility and to apply that facility to the solution of astronomical problems. During the course of the contract we have developed the procedures, algorithms, theory and hardware required to perform that function and have made and interpreted astronomical observations of substantial significance. A principal result of the program was development of a photon-counting camera of innovative design, the PAPA detector. Development of this device was, in our view, essential to making the speckle process into a useful astronomical tool, since the principal impediment to that circumstance in the past was the necessity for application of photon noise compensation procedures which were difficult if not impossible to calibrate. The photon camera made this procedure unnecessary and permitted precision image recovery. The result of this effort and the associated algorithm development was an active program of astronomical observation which included investigations into young stellar objects, supergiant structure and measurements of the helium abundance of the early universe. We have also continued research on recovery of high angular resolution images of the solar surface working with scientists at the Sacramento Peak Observatory in this area. GRA

N87-15037# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
THE RELATION OF BACTERIAL ABSORPTIVITY IN THE 3 TO 4 MICRON WAVEBAND TO OBSERVATIONS OF GC-IRS7 AND SUNDRY COMMENTS
F. Hoyle and N. C. Wickramasinghe Sep. 1984 33 p
(Preprint-108; ETN-86-98360) Avail: NTIS HC A03/MF A01

It is shown that bacterial absorptivity fits very well to observations of GC-IRS 7 over the whole waveband from 2.9 to 3.9 microns. This refutes Kroto's (1983) suggestion of fraud in the presentation of figure 2 of Hoyle et al in Astrophys. Sp. Sci. 1982, 83, 405. ESA

N87-15038# Bonn Univ. (West Germany). Inst. fuer Geodaesie.
DELAY ESTIMATION IN DIGITAL CORRELATION INTERFEROMETERS WITH SPECIAL CONSIDERATION OF THE MK 2

SYSTEM OF THE MAX-PLANCK INSTITUTE OF RADIO ASTRONOMY Ph.D. Thesis [LAUFZEITSCHAETZUNG IN DIGITALEN KORRELATIONSINTERFEROMETERN UNTER BESONDERER BETRACHTUNG DES MK 2-SYSTEMS DES MAX-PLANCK-INSTITUTS FUER RADIOASTRONOMIE]

Winfried Kurt George Beyer 1985 165 p In GERMAN
(Rept-68; ISSN-0723-4325; ETN-87-98732) Avail: NTIS HC A08/MF A01

The estimation accuracy of the group delay measured in a single video frequency band was analyzed as a function of the system bandwidth and the signal to noise ratio. Very long base interferometry (VLBI) measurements from geodetic experiments were used to check the geodetic applicability of the Mark 2 evaluation system. The geodetic observation quantities and the correlation geometry are introduced. The data flow in the VLBI experiment, the correlation analysis, the analyses and evaluation in the MK2 system, and the delay estimation procedure following the least squares method are presented. It is shown that the MK2 system is no longer up to date for geodetic applications. The superiority of the developed estimation method with respect to the interpolation algorithm is demonstrated. The numerical investigations show the deleterious influence of the distorting bit shift effects. ESA

N87-15039# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Institut fuer Extraterrestrische Physik.
THE X-RAY AND GAMMA-RAY ASTRONOMY (INCLUDING NON-PHOTON ASTRONOMY)

Bernd Aschenbach Jul. 1986 12 p Presented at the European Physical Society Seminar on International Research Facilities, London, England, 17-19 Mar. 1986
(MPE-Preprint-58; ETN-87-98872) Avail: NTIS HC A02/MF A01

Facilities for X-ray, gamma ray, and neutrino astronomy are described. Astronomical satellites are listed. Gamma ray and X-ray missions are outlined. Underground experiments to detect neutrinos are introduced. ESA

N87-15040# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
HETERODYNE SPECTROSCOPY OF PLANETARY AND STELLAR ATMOSPHERES AT A WAVELENGTH OF 11 MICROMETERS [HETERODYNSPEKTROSKOPIE AN PLANETEN- UND STERNATMOSPHAEREN BEI 11 MICROMETER WELLENLAENGE]

Ulrich Schrey Jul. 1986 115 p In GERMAN
(MPE-198; ISSN-0178-0719; ETN-87-98874) Avail: NTIS HC A06/MF A01

A heterodyne spectrometer for the 10 micron wavelength range was used for the investigation of absorption lines in planetary and stellar atmospheres with very high resolution. The atmosphere of Mars and the circumstellar envelopes of bright IR stars were investigated using IR telescopes. The Mars observations provide the isotope ratios C-12/C-13 and O-16/O-18, the large scale temperature distribution of the upper atmosphere (which shows a substantially higher temperature above the Mars North Pole than above the subsolar point) and emission structures in the absorption lines of C13O2 which indicate very cold atmospheric layers. In the envelope of the carbon star IRC+10216 absorption lines of SiH4 were measured; the envelope of R Leonis shows MH3 absorption lines. The results demonstrate the realizability of an imaging heterodyne system. ESA

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

For related information see also *75 Plasma Physics*.

N87-15041 University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
THE MYSTERY OF THE MISSING SHORTER PERIOD COMETS

Fred Hoyle May 1986 91 p
(Preprint-123; ETN-86-98363) Avail: NTIS HC A05

The effects of stars passing through the Oort Cloud of comets, which causes a fraction of the population to plunge inwards towards Jupiter, are analyzed. Jupiter perturbs the orbits in a stochastic way. Analysis of the long term effects shows that theory predicts significantly more shorter-period comets than are observed. A theory which attributes the evolution of cometary orbits to small but systematic nongravitational effects leads to the same discrepancy. The cometary fading explanation is also unsatisfactory. ESA

N87-15042# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
TEMPORAL CHARACTERISTICS OF SOLAR EUV, UV AND 10830-A FULL-DISK FLUXES

R. F. Donnelly, L. C. Puga, and W. S. Busby Jun. 1986 129 p
(PB86-231271; NOAA-TM-ERL-ARL-146) Avail: NTIS HC A07/MF A01 CSCL 03B

The temporal characteristics of full-disk solar EUV flux measurements from the AE-E satellite are examined for 15 wavelength groups and compared with independent NIMBUS-7 satellite measurements at UV wavelengths and ground-based measures of solar activity. Unusual temporal variations are illustrated as well as systematic patterns in the temporal variations as a function of the source temperature or source region in the solar atmosphere. GRA

N87-15043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMER SCHOOL ON INTERSTELLAR PROCESSES: ABSTRACTS OF CONTRIBUTED PAPERS

D. J. Hollenbach, ed. and Harley A. Thronson, Jr., ed. (Wyoming Univ., Laramie.) Oct. 1986 205 p Workshop held at Grand Teton National Park, Wyo., 3-7 Jul. 1986; sponsored by the American Astronomical Society, El Inst. de Astronomia, Wyoming Univ., and the Canadian Astronomical Society
(NASA-TM-88342; A-86393; NAS 1.15:88342) Avail: NTIS HC A10/MF A01 CSCL 03B

The Summer School on Interstellar Processes was held to discuss the current understanding of the interstellar medium and to analyze the basic physical processes underlying interstellar phenomena. Extended abstracts of the contributed papers given at the meeting are presented. Many of the papers concerned the local structure and kinematics of the interstellar medium and focused on such objects as star formation regions, molecular clouds, HII regions, reflection nebulae, planetary nebulae, supernova remnants, and shock waves. Other papers studied the galactic-scale structure of the interstellar medium either in the Milky Way or other galaxies. Some emphasis was given to observations of interstellar grains. For individual titles, see N87-15044 through N87-15130.

N87-15044*# London Univ. (England).
FAR-INFRARED INVESTIGATION OF THE TAURUS STAR-FORMING REGION USING THE IRAS DATABASE Abstract Only

Joanne D. Hughes *In* NASA. Ames Research Center Summer School on Interstellar Processes; Abstracts of Contributed Papers Oct. 1986 p 1-2 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The Infrared Astronomical Satellite (IRAS) has given us the first completely unbiased sky-survey in the far-infrared with wavebands centered at 12, 25, 60 and 100 microns. The Taurus-Auriga complex was selected as the first molecular cloud to be investigated in this study. The Taurus clouds were defined as lying between 04h and 05h in R.A. and +16 to +31 degrees in Dec., then the IRAS point-source catalogue was searched for sources with good or moderate quality fluxes in all three of the shortest IRAS bands. The sources which were selected in this way were then classified into subgroups according to their IRAS colors. Taurus is generally believed to be an area of low-mass star formation, having no luminous O-B associations within or near

to the cloud complex. Once field stars, galaxies and planetary nebulae had been removed from the sample only the molecular cloud cores, T Tauri stars and a few emission-line A and B stars remained. The great majority of these objects are pre-main sequence in nature and, as stated by Chester (1985), main sequence stars without excess far-infrared emission would only be seen in Taurus if their spectral types were earlier than about A5 and then not 25 microns. By choosing our sample in this way we are naturally selecting the hotter and thus more evolved sources. To counteract this, the molecular cloud core-criterion was applied to soruces with good or moderate quality flux at 25, 60 and 100 microns, increasing the core sample by about one third. The candidate protostar B335 is only detected by IRAS at 60 and 100 microns while Taurus is heavily contaminated by cirrus at 100 microns. This means that detection at 25 microns is also required with those at 60 and 100 microns to avoid confusing a ridge of cirrus with a genuine protostar. The far-infrared luminosity function of these sources is then calculated and converted to the visual band by a standard method to compare with the field star luminosity function of Miller and Scalo. The eventual aim of this work is to obtain far-infrared luminosity functions for a number of molecular clouds which are known to be forming low-mass stars and to investigate how the slope is affected by changes in the density and turbulence of material. Author

N87-15045*# London Univ. (England).
MM AND SUBMM MOLECULAR LINE OBSERVATIONS OF THE SOUTHWEST LOBE OF L1551: EVIDENCE OF A SHELL STRUCTURE Abstract Only
Ruth Rainey, Glenn J. White, K. J. Richardson, M. J. Griffin, J. Cronin (Bath Univ. (England).), J. Hilton, and T. S. Monteiro (Newcastle-upon-Tyne Univ. (England).) *In* NASA. Ames Research Center Summer School on Interstellar Processes; Abstracts of Contributed Papers Oct. 1986 p 3-4 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Observations have been made of the southwest outflow lobe of L1551 in several millimeter and submillimeter molecular lines. Maps have been made in the J=3-2 and J=2-1 transitions of CO over areas of 7.5 by 2.5 arc minutes and 5 by 5 arc minutes respectively at UKIRT. More detailed maps have also been made in the J=2-1 CO transition over an area of about 6 by 3.5 arc minutes at the NRAO 12m telescope. Additional observations of the J=4-3 transitions of HCN, HCO(+) abd H(13)CO(+) were made at selected positions. The HC(+) J=4-3 transition was detected at several positions along the outflow axis and at the position of IRS 5. Similarly the HCN J=4-3 transition was detected at the position of IRS 5 and also at a position close to HH29. However, the J=4-3 transition of H(13)CO(+) was bit detected at the position of IRS 5 even through it was observed at the position close to HH29 with a peak corrected antenna temperature of 0.23K at a V(LSR) of 1 km s(-1). The detection of the J=4-3 transitions of both HCO(+) and H(13)CO(+) close to the position of HH29 suggest the presence of very dense gas in this region. LVG analysis of the various molecular lines observed give a kinetic temperature between 10 and 15K and a density from 10(5) to 10(6) cm(-3) at the position of IRS 5 at the ambient cloud velocity. At the position close to HH29 LVG analysis of the CO observations gives a density between 10(3) and 10(4) cm(-3) at a kinetic temperature of 25k for a V(LSR) of 0 km s(-1). To the southwest of HH29 there is a large decrease in both the linewidth and intensity of CO emission. This may be due to the interaction between the outflow and a dense clump of gas which gives rise to HH29. The maps of the CO J=3-2 and CO J=2-1 emission integrated in 3.25 km s intervals show the shell structure postulated by Snell and Schloerb (1985). Author

N87-15046*# Massachusetts Univ., Amherst.
HIGH RESOLUTION OBSERVATIONS OF THE L1551 BIPOLAR OUTFLOW Abstract Only
Ronald Snell, Gerald Moriarty-Schieven, Stephen Strom, Peter Schloerb, Karen Strom, and Gary Grasdalen (Wyoming Univ., Laramie.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 5-6 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The nearby dark cloud Lynds 1551 contains one of the closest examples of a well-collimated bipolar molecular outflow. This source has the largest angular size of any known outflow and was the first bipolar outflow to be detected. The outflow originates from a low-luminosity young stellar object, IRS-5. Optical and radio continuum observations show the presence of a highly collimated, ionized stellar wind orginating from close to IRS-5 and aligned with the molecular outflow. However, we have little information on the actual mechanism that generates the stellar wind and collimates it into opposed jets. The Very Large Array (VLA) observations indicate that the winds originate within 10(15) cm of IRS-5, unfortunately at a size scale difficult to resolve. For these reasons, observations of the structure and dynamics of the hypersonic molecular gas may provide valuable information on the origin and evolution of these outflows. In addition, the study of the impact of the outflowing gas on the surrounding molecular material is essential to understand the consequence these outflows have on the evolution and star formation history of the entire cloud. Moriarty-Schieven et al. (1986) obtained a oversampled map of the CO emission of a portion of both the blueshifted and redshifted outflows in LI551 using Five College Radio Astronomy Observatory 14 m telescope. The oversampled maps have been reconstructed to an effective angular resolution of 20 arcsec using a maximum entropy algorithm. A continuation of the study of Moriarty-Schieven et al. is presented. The entire L1551 outflow has now been mapped at 12 arcsec sampling requiring roughly 4000 spectra. This data has been constructed to 20 arcsec resolution to provide the first high resolution picture of the entire L1551 outflow. This new data has shown that the blueshifted lobe is more extended than previously thought and has expanded downstream sufficiently to break out of the dense molecular cloud, but the redshifted outflow is still confined within the molecular cloud. Details of the structure and kinematics of the high velocity gas are used to test the various models of the origin and evolution of outflows. M.G.

N87-15047*# California Inst. of Tech., Pasadena. Lab. of Physics.
A COMPACT DENSITY CONDENSATION AROUND L1551-IRS 5: 2.7mm CONTINUUM OBSERVATIONS WITH 4' RESOLUTION Abstract Only
Jocelyn Keene and Colin Masson *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 7-8 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The dark cloud L1551 contains the best known examples of bipolar molecular outflow. Such outflows are assumed to be driven by winds from young stars embedded in a cloud but the mechanism for collimation of the outflows is still in doubt, though it has been much debated. Among the possibilities put forth to date are intrinsically anisotropic stellar winds, isotropic stellar winds collimated by interstellar toroidal shaped clouds on the order of 10(17) cm in size, or circumstellar disks of order 10(15) cm in size. Because the outflow in L1551 as revealed by the Very Large Array (VLA) cm continuum observations is collimated even at the arc second level it seems as though the stellar wind powering the outflow must either be initially anisotropic or be collimated by something very close to the star, such as a circumstellar disk. We have observed L1551 in the continuum at 2.7 mm with the OVRO millimeter-wave interferometer in the winter of 1983-4 and again, more extensively, in 1985-6. The resulting map shows for the first time direct evidence for a density condensation capable of collimating an initially isotropic flow from IRS 5. This map made from data taken in 1985-6 with projected baselines up to 100 m in length (37k lambda). It has been cleaned and reconstructed with a 4" gaussian beam. It shows a nearly unresolved source with a suggestion of extension at the 3" level (assuming a gaussian source shape). The integrated flux density in this map is 170 mJy. A composite spectrum of L1551 is presented which

shows that the flux at 2.7 mm is due to the thermal radiation from dust that is also seen at shorter wavelengths. Very little of it can be due to the continuation of the nearly flat cm wavelength spectrum which is assumed to be from thermal bremsstrahlung radiation. The map and spectrum provide strong constraints on the size, temperature, and optical depth of the density condensation surrounding IRS 5. Author

N87-15048*# Texas Univ., Austin. Dept. of Astronomy.
IMAGE RESTORATION AND SUPERRESOLUTION AS PROBES OF SMALL SCALE FAR-IR STRUCTURE IN STAR FORMING REGIONS Abstract Only
D. F. Lester, P. M. Harvey, M. Joy, and H. B. Ellis, Jr. *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 9-10 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Far-infrared continuum studies from the Kuiper Airborne Observatory are described that are designed to fully exploit the small-scale spatial information that this facility can provide. This work gives the clearest picture to data on the structure of galactic and extragalactic star forming regions in the far infrared. Work is presently being done with slit scans taken simultaneously at 50 and 100 microns, yielding one-dimensional data. Scans of sources in different directions have been used to get certain information on two dimensional structure. Planned work with linear arrays will allow us to generalize our techniques to two dimensional image restoration. For faint sources, spatial information at the diffraction limit of the telescope is obtained, while for brighter sources, nonlinear deconvolution techniques have allowed us to improve over the diffraction limit by as much as a factor of four. Information on the details of the color temperature distribution is derived as well. This is made possible by the accuracy with which the instrumental point-source profile (PSP) is determined at both wavelengths. While these two PSPs are different, data at different wavelengths can be compared by proper spatial filtering. Considerable effort has been devoted to implementing deconvolution algorithms. Nonlinear deconvolution methods offer the potential of superresolution -- that is, inference of power at spatial frequencies that exceed D lambda. This potential is made possible by the implicit assumption by the algorithm of positivity of the deconvolved data, a universally justifiable constraint for photon processes. We have tested two nonlinear deconvolution algorithms on our data; the Richardson-Lucy (R-L) method and the Maximum Entropy Method (MEM). The limits of image deconvolution techniques for achieving spatial resolution are addressed. M.G.

N87-15049*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Physics.
MODELING OF INFRARED FLUX SPECTRA FROM DISK-SHAPED INTERSTELLAR DUST CLOUDS Abstract Only
George F. Spagna, Jr. and Chun Ming Leung *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts on Contributed Papers Oct. 1986 p 11-12 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Although there is growing observational and theoretical evidence for many disk-shaped objects of astrophysical interest, spherical geometry is assumed in most radiative transfer models. Recently we generalized the quasi-diffusion method developed by Leung (1975, 1976) for spherical geometry to solve the problem of scattering, absorption, and reemission by dust grains in a medium of disk geometry. The method is applicable to a variety of astronomical sources whose dynamics are angular-momentum dominated and hence not accurately treated by spherical geometry, e.g., protoplanetary nebulae, circumstellar disks, bipolar-flow molecular clouds, accretion disks and disk galaxies. Using this technique and realistic grain opacities we construct theoretical models to determine self-consistently the dust temperature distribution and infrared emission from disk-shaped, quiescent dark globules heated externally by the interstellar radiation field. The effects of the following parameters on the temperature structure and the emergent spectrum are studied: grain type (graphite and silicate), optical depth, density inhomogeneity, and degree of disk flattening. The disk models are characterized by an aspect ratio and an optical depth at 0.55 microns. For inhomogeneous models, a gaussian density distribution is assumed such that the ratio of central to surface density is 100. To study the effects of source geometry, we also compare results for models with spherical and disk geometry. In this case both models have the same radius and central optical depth, the disk models having a 1:1 aspect ratio. While the dust temperature distributions in the two cases are very similar, the emergent flux for the disk model depends sensitively on the viewing angle. For clouds which are unresolved, one would expect, since the thermal emission is isotropic in the neighborhood of an emitting grain, and since the emission (in the far infrared) is optically thin, that the emergent flux spectrum should be characteristic only of the dust temperature, and independent of viewing angle. However, because of the lack of complete symmetry and the resulting radiation anisotropy, this is found not to be the case for the disk models. Angle is that it implies a large uncertainty in estimating the radiation dust mass. Author

N87-15050*# Wyoming Univ., Laramie. Infrared Observatory.
MODELS OF POLARIZED INFRARED EMISSION FROM BIPOLAR NEBULAE Abstract Only
M. Shane Burns, Paul Johnson, and Harley A. Thronson, Jr. *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 13-14 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Many stars with circumstellar dust shells show a high degree of linear polarization (Sato et al. 1985). We are developing a model which assumes that the polarization arises from scattering by circumstellar dust. Our model assumes a geometry in which the star is surrounded by an optically thin spherical dust shell and embedded within an optically thick disk. This geometry is consistent with that proposed for objects with bipolar molecular outflow. This is important because many bipolar flow objects have also been observed to be highly polarized. The high degree of linear polarization is produced because the disk differentially attenuates the light from the star. The light incident from the point source is attenuated by a factor of exp(-tau/cos theta) where theta is the angle between a ray from the point source to the scatterer and a ray normal to the disk; tau is the optical depth at the wavelength of interest. Hence, the light scattered from the regions directly above and below the disk give the largest contribution to the total flux. The scattering angle for light from these regions is near 90 deg., so the light is strongly polarized and, in the Rayleigh scattering regime, is polarized parallel to the disk. The Stokes parameters for the scattered light from each particle in the shell are calculated by using the scattering matrix elements generated by a Mie scattering program. After the Stokes parameters for each particle are computed they are summed to give the Stokes parameters for the entire shell. Two graphs are presented which show the intensity and polarization spectrum generated by our model using the optical constants for astronomical silicates as defined by Draine and Lee (1984). Author

N87-15051*# California Inst. of Tech., Pasadena.
ARE YOUNG STARS ALWAYS ASSOCIATED WITH COLD MASSIVE DISKS? A CO AND MILLIMETER INTERFEROMETRIC CONTINUUM SURVEY Abstract Only
L. G. Mundy, B. A. Wilking (Missouri Univ., St. Louis.), S. Myers, J. E. Howe (Texas Univ., Austin.), J. H. Blackwell (Missouri Univ., St. Louis.), and L. Likkel (California Univ., Los Angeles.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 15-16 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The results of a combined millimeter-spectral-line and continuum survey of cold far-infrared sources selected to favor embedded young stars in the Galaxy are presented. The spectral-line observations were performed with the 5 meter antenna of the University of Texas Millimeter-Wave Observatory. High resolution continuum observations were obtained with the Owens Valley

(OVRO) Millimeter-Wave Interferometer. The goal of the survey was to gain insight into the mass, temperature, and distribution of cold dust which envelopes stars during the earliest stages of their evolution. The first phase of our survey involved 1.2 arcmin resolution observations of CO-12 and CO-13 emission lines toward each source. All but two sources had detectable CO emission. We found that 40% of the sources appear to be associated with star formation as evidenced by the presence of enhanced CO-12 line widths or broad wings. At least five of these objects are associated with bipolar molecular outflows. The second phase of our survey involves high resolution 2.7 mm continuum observations with 3 interferometer baselines ranging from 15 to 55 m in length. Preliminary results indicate that about 25% of the sources in our sample have detectable continuum emission on scales less than 30 arcsec. The high percentage of sources with enhanced CO-12 line widths or broad wings indicates that a significant fraction of our samples, 40%, are likely to be young stars. The lower detection percentage in the continuum observations, 25%, suggest that such objects are not always surrounded by large concentrations of gas and dust. The continuum detection percentage for actual dust emission could be lower than that given above since emission from ionized gas could be responsible for the observed 2.7 mm emission in some objects. To get an understanding of the type of object detected in our survey, a map of one of the survey sources, L1689N, has been made using the OVRO mm interferometer.

Author

N87-15052*# Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Astronomia.

THE ASYMMETRIC PROFILE OF THE H76 ALPHA LINE EMISSION FROM MWC349 Abstract Only

L. F. Rodriquez, J. Canto, V. Escalante (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.), and J. M. Moran *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 17-18 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

MWC349 is an emission-line star found by Merrill, Humason and Burwell (1932). Braes, Habing and Schoenmaker (1972) discovered that it is a strong radio source. The radio emission originates in a massive ionized wind that is expanding with a velocity of about 50 km s(-1). Its continuum spectrum fits well a nu(0.6) power law from the cm wavelengths to the far-IR. Radio recombination line emission from the envelope of MWC349 was first detected by Altenhoff, Strittmatter and Wendker (1981). We have obtained good signal-to-noise ratio, Very Large Array observations of the H76 alpha radio recombination line from the ionized wind of MWC349. Our data reveal that the profile is markedly asymmetric, with a steep rise on the blue side. This asymmetry could be due to non-LTE effects in the formation and transfer of the line or to intrinsic asymmetries in the envelope. Our analysis suggests that most probably the peculiar profile is caused by a non-LTE enhancement of the line emission from the side of the envelope nearer to the observer. This asymmetry has the opposite sense than that observed in optical and IR recombination lines, where a different effect (absorption of the stellar continuum by the gas in the wind between the star and the observer) is known to be dominant, leading to the classic P Cygni profile. We propose that the profiles of the radio recombination lines from ionized stellar winds will have this characteristic shape, while optical and IR recombination lines are characterized by P Cygni-like profiles. Unfortunately, at present the detection of radio recombination lines from ionized stellar winds is only feasible for MWC349 and a few other objects.

Author

N87-15053*# Herzberg Inst. of Astrophysics, Ottawa (Ontario).

C3H2 OBSERVATIONS AS A DIAGNOSTIC PROBE FOR MOLECULAR CLOUDS Abstract Only

L. W. Avery *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 19-21 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Recently the three-membered ring molecule, cyclopropenylidene, C3H2, has been identified in the laboratory and detected in molecular clouds by Thaddeus, Vrtilek and Gottlieb (1985). This molecule is wide-spread throughout the Galaxy and has been detected in 25 separate sources including cold dust clouds, circumstellar envelopes, HII regions, and the spiral arms observed against the Cas supernova remnant. In order to evaluate the potential of C3H2 as a diagnostic probe for molecular clouds, and to attempt to identify the most useful transitions, statistical equilibrium calculations were carried out for the lowest 24 levels of the ortho species and the lowest 10 levels of the para species. Many of the sources observed by Matthews and Irvine (1985) show evidence of being optically thick in the 1(10)-1(01) line. Consequently, the effects of radiative trapping should be incorporated into the equilibrium calculations. This was done using the Large Velocity Gradient approximation for a spherical cloud of uniform density. Some results of the calculations for T(K)=10K are given. Figures are presented which show contours of the logarithm of the ratio of peak line brightness temperatures for ortho-para pairs of lines at similar frequencies. It appears that the widespread nature of C3H2, the relatively large strength of its spectral lines, and their sensitivity to density and molecular abundance combine to make this a useful molecule for probing physical conditions in molecular clouds. The 1(10)-1(01) and 2(20)-2(11) K-band lines may be especially useful in this regard because of the ease with which they are observed and their unusual density-dependent emission/absorption properties.

M.G.

N87-15054*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

A 43GHz VLBI MAPPING OF SiO MASER EMISSION ASSOCIATED WITH ORION-KL IRC-2 Abstract Only

Lincoln J. Greenhill and James M. Moran *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 22 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

A milliarcsecond resolution spot map of the SiO maser emission associated with IRC-2 in Orion-KL is presented. The two dominant groups of spectral features, near V(LRS) = -6 and 16 km/s, were observed in the 43 GHz, v = 1 to 0 transition of SiO, using a Mark III VLBI system. The 74 km baseline ran from Haystack Observatory in Westford, Massachusetts to Five College Radio Astronomy Observatory (FCRAO) in New Salem, Massachusetts. Five distinct maser features were observed: -8.5 to -6.5 km/s; -5 to -1.5 km/s; 12 to 13.5 km/s; 16.5 to 19 km/s; and 20 to 21 km/s (stellar velocity = 5 km/s). The relative positions were established, from an analysis of fringe phases, to an accuracy of about 5 milliarcseconds. All the features lay within an area of radius 0.08 arcseconds or 6x10(14) cm, at a distance of 500 pc. Previous interferometric studies were only able to measure the gross separation between the red and the blue shifted groups. Our measurement of the separation between these two gropus is consistent with those of the previous studies, indicating the persistence of these two centers of activity. The absolute positions of the masers with respect to IRC-2 are only known to an accuracy of about 1 arcsecond. It is assumed that IRC-2 is centered between the red shifted and the blue shifted maser features. The relative placement of these two groups of maser features agrees with observations of thermal emission from SO, which traces the outflow on a much larger scale. The SiO masers trace the neutral outflow from IRC-2 on the smallest scale yet observed.

Author

N87-15055*# National Radio Astronomy Observatory, Tucson, Ariz.

PERVASIVE SMALL-SCALE STRUCTURE IN MOLECULAR CLOUDS Abstract Only

Buddy Martin and Elizabeth Lada (Texas Univ., Austin.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 23-24 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

An unbiased CO survey of molecular cloud cores was completed, and the profiles were analyzed within the context of a

model for emission from clumpy clouds. It was found that all sources observed contain a significant amount cf structure that is not resolved with our 2.3-arcmin beam, and that the parameters which describe the degree of clumping span a remarkably narrow range of the possible values. We studied two separate samples of cloud cores: a large sample of warm cores from the Massachusetts-Stony Brook 12CO survey of the first galactic quadrant, and a sample of cool cores in the Taurus dark clouds chosen primarily on the basis of H2CO emission. We observed all sources in the 1-0 transition of 12CO and 13CO with the 5-m telescope of the Millimeter Wave Observatory. The 12CO/13CO ratios can be explained if there is unresolved structure giving rise to significant variations of opacity across the beam. Our model cloud consists of a large number of identical clumps distributed randomly in the beam. These clumps have velocity widths v small compared to the width of the observed profile, which is determined by the relative motion of the clumps. The entire cloud is isothermal and in local thermodynamic equilibrium. With these assumptions the intensity and linewidth ratios depend on three parameters: the abundance ratio; the peak 13CO opacity through a single clump, tau(0); and the average number of clumps on a line of sight N. Small tau(0) and large N correspond to the microturbulent limit, which is indistinguishable from a uniform gas distribution. In the other extreme, large tau(0) and snall N, at a given velocity at most one clump contributes to the profile on each line of sight. A figure is presented which shows the model parameters which reproduce the measured intensity and linewidth ratios for the sample of warm cores, assuming an abundance ratio of 75. M.G.

N87-15056*# California Inst. of Tech., Pasadena.
HC3N MAPS OF OMC1 Abstract Only
Colin R. Masson and Lee G. Mundy *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 25-26 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

We have made 3.8 sec resolution maps of HC3N (J = 12-11) and 2.7 mm continuum emission in OMC1 using the OVRO mm interferometer. The continuum map, which traces dust column density, shows that the hot core region consists of several clumps, the densest of which lies 3 sec SE of IRc2. HC3N, which traces dense gas, shows the velocity structure in the region. There is no simple pattern of rotation or expansion, nor does the emission resemble a disk centered on IRc2. Since the velocity difference between the hot core and IRc2 and the velocity dispersion in the hot core are comparable with the orbital velocity at a distance of 3 sec. from a 20 M(solar) object, it is possible that the hot core material is bound to IRc2. In the channel at 10.4 km s(-1) V(LSR), we detect strong emission from the source 20 sec NE of IRc2, which confirms indications from continuum and CS (J = 2-1) maps that this is a very dense, possibly protostellar, object. This emission is clearly resolved from the hot core and is elongated north-south, along the direction of the ridge emission. An additional interesting feature in these maps is a compact high velocity source located 4 sec SW of IRc2. This source has a velocity dispersion greather than 20 km/s (FWHM) and is spatially coincident with the zero-offset source seen by Pauls et al. (1983) and a point source in the near IR images taken by Allen et al. (1984). The large localized velocity, dispersion and the highly obscured IR source suggest that this compact source is an outflow from a young stellar companion to IRc2. Author

N87-15057*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
CO MAPPING OF THE ORION MOLECULAR CLOUD: THE INFLUENCE OF STAR FORMATION ON CLOUD STRUCTURE Abstract Only
F. Peter Schloerb, Ronald L. Snell, Paul F. Goldsmith, and James A. Morgan *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 27-28 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Regions of massive star formation have long been believed to have a profound influence on the structure of their surrounding molecular clouds. The ways in which massive star formation has altered the structure and kinematics of the Orion Molecular Cloud are discussed. The data to be discussed consists of a large scale map of the CO J=1-0 emission from approximately 3 square degrees of OMC-1. During 1985, the Five College Radio Astronomy Observatory 14M antenna was used to map a 2 deg x 1 deg region centered on alpha(1950) = 5(h)33(m)00(s) delta (1950) = -5 deg 30 min. The region mapped in 1985 covers the well known HII regions M42, M43, and NGC1977, and the CO map contains abundant evidence of the interaction between these regions and the molecular cloud. Indeed, the global structure of the cloud appears to have been strongly influenced by the continuous formation of massive stars within the cloud. Individual instances of some of these features are discussed. There appear to be two classes of features which are indicative of this interaction: CO bright rims and CO holes. During 1986, we have undertaken further mapping of OMC-1 to the south of the region covered by the 1985 map. This portion of the cloud contains significant regions of star formation, but O star formation has not occured and large HII regions have not developed to alter the appearance of the cloud. A detailed map of this region is thus an opportunity to view the structure of the molecular cloud before it has been altered by massive star formation. Preliminary analysis of data obtained in this region suggests that the structure and kinematics of the southern portion of the Orion cloud are indeed dramatically different from those of the region previously mapped. Comparison of the two regions thus supports models of the development of structure in molecular clouds through interaction with the HII regions formed within them. M.G.

N87-15058*# Bell Telephone Labs., Inc., Holmdel, N. J.
FILAMENTARY STRUCTURE IN THE ORION MOLECULAR CLOUD Abstract Only
John Bally, Mark Dragovan, William D. Langer (Princeton Univ., N. J.), Antony A. Stark, and Robert W. Wilson *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 29-30 (For primary document see N87-15043 06-90)
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A large scale 13CO map (containing 33,000 spectra) of the giant molecular cloud located in the southern part of Orion is presented which contains the Orion Nebula, NGC1977, and the LI641 dark cloud complex. The overall structure of the cloud is filamentary, with individual features having a length up to 40 times their width. This morphology may result from the effects of star formation in the region or embedded magnetic fields in the cloud. We suggest a simple picture for the evolution of the Orion-A cloud and the formation of the major filament. A rotating proto-cloud (counter rotating with respect to the galaxy) contians a b-field aligned with the galaxtic plane. The northern protion of this cloud collapsed first, perhaps triggered by the pressure of the Ori I OB association. The magnetic field combined with the anisotropic pressure produced by the OB-association breaks the symmetry of the pancake instability, a filament rather than a disc is produced. The growth of instabilities in the filament formed sub-condensations which are recent sites of star formation. M.G.

N87-15059*# Bentley Coll., Boston, Mass.
H AND K MAPS OF TWO STAR-FORMING REGIONS: S 140 AND CEP A OB3
G. L. Graadalen, J. A. Hackwell, and R. D. Gehrz (Wyoming Univ., Laramie.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 31-32 (For primary document see N87-15043 06-90)
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The molecular clouds near S 140 and Cep A OB3 both contain regions that emit strongly in the infrared but which have relatively little or no emission in radio wavelengths. The lack of radio emission is usually interpreted to mean that little ionization has taken place, and that the IR emission comes from dust heated by a central pre-main sequence object. We have made high resolution maps of these two areas with H and K broadband

filters with the 2.3m telescope of the Wyoming Infrared Observatory (WIRO). Our observations were made with an InSb detector using the standard WIRO mapping technique of multiple scanning to construct a series of 64x64 pictures. Our scanning was made in one arcsec steps with a 7 inch aperture to produce a resolution of about 6 sec FWHM. Observations of S 140 by Blair et al (1978) with moderate resolution in J, H, and K, revealed a prominent IR source that they called S 140IR. We have scanned an area surrounding their S 140IR region and have obtained total IR fluxes which are in close agreement with Blair et al. Additional detail corresponds to that seen by Dinerstein et al (1979) at 0.9 microns and Campbell (1986) at 1.0 microns. The large (H-K) values for all components of S 140IR indicates that they are probably embedded in the parent molecular cloud with A(v) = 25 mag and A(K) = 2.2 mag. Recent radio studies of Cep A by Hughes and Wouterloot (1984) and FIR studies by Evans et al (1981) have shown the similarity of Cep A to S 140. There is, however, some emission detected from ionized regions by the radio observations, indicating a slightly more advanced stage of evolution for Cep A. We observed an area around the strongest source in Cep A in both H and K, and the K map is presented. We have identified three sources separate from the main source. Author

N87-15060*# London Univ. (England).
SUBMILLIMETRE MOLECULAR LINE OBSERVATIONS OF M17: THE INTERACTION OF AN IONISATION FRONT AND MOLECULAR CLOUDS
Ruth Rainey, Glenn J. White, Ian Gatley (United Kingdom Infrared Telescope Unit, Hilo, Hawaii.), S. S. Hayashi (Nobeyema Solar Radio Observatory (Japan).), N. Kaifu, M. J. Griffin, S. Monteiro (Newcastle-upon-Tyne Univ. (England).), N. J. Cronin (Bath Univ. (England).), and A. Scivetti *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 33-34 (For primary document see N87-15043 06-90)
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An area of about 9 by 10 arc minutes in the M17 molecular cloud has been mapped in the J=3-2 transition of CO. The strongest CO emission is observed to come from the two bars to the north and southwest, which lie just outside the area of ionized gas seen in the radio continuum studies. We are viewing the boundary between the ionized and molecular gas almost edge on. The most intense CO emission is from the area around the dense molecular cloud core M17SW in the southwest bar. To the east of M17SW there are signs of recent or continuing star formation including H2O masers and an ultra-compact HII region. The CO J=3-2 spectra observed are complex with considerable variation in line shapes occuring over distances of less than one arc minute. We interpret the velocity structure of this region as arising from an ensemble of molecular cloud fragments in addition to extended emission. We have identified several cloud components at different velocities within both the northern and southwest bars of CO emission. A simple kinematic model of the cloud components in the southwest bar in which they are considered to be clumps of post-shock gas lying close to the edge of the expanding HII region, with the shock being driven by Kleinmann's star, gives a velocity of approx. 10.8 km s(-1) for the expansion velocity of the HII region, which is currently at a distance of approx. 2.4 pc from Kleinmann's star. The resulting shock is thought to be preceding the ionisation front and appears to have led to the fragmentation of the original cloud. Author

N87-15061*# California Univ., Berkeley.
NEAR-INFRARED OBSERVATIONS OF IRAS SOURCES IN AND NEAR DENSE CORES Abstract Only
G. A. Fuller, P. C. Myers (Center for Analysis, Newport Beach, Calif.), R. D. Mathieu, C. A. Beichman, P. J. Benson (Wellesley Coll., Mass.), and R. E. Schild (Center for Analysis, Newport Beach, Calif.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 35-36 (For primary document see N87-15043 06-90)
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We report 0.4 to 20 micron photometry of 27 Infrared Astronomy Satellite (IRAS) point sources associated with dense cores in nearby dark clouds. It is found that these objects have a bimodal distribution of spectral slopes. The objects in the group with steep spectral slopes are typically within one half power radius of the core peak and are not visible on the POSS. The remainder of the objects are typically further from their cores, are optically visible and have shallow spectral slopes (s is approximately 0.6). Most of the sources in this group which have been previously identified are T Tauri stars. Both the groups of objects have essentially the same luminosity function with median luminosity of 1 to 2 L(solar), which is similiar to the luminosity function for T Tauri stars. The near-infrared (J,H,K,L) colors of the objects have been used to estimate the visual extinction to the stars. This indicates that the typical steep spectrum source has extinction A(upsilon) of approximately 30 magnitudes, which is larger by a factor of 3 to 4 than a uniform core can provide, thus the density must rise steeply in the vicinity of the star. For those objects where optical estimates of the extinction are available the optical estimates are typically smaller than our IR estimates by a factor of 1.6. For multiple scattering by grains that scatter primarily in the forward direction, this implies a grain albedo of 0.4 at V, consistent with theoretical predictions for bare grains. Using this derived extinction, the FIR emission from a spherical shell with an inverse power law density which contributes the correct amount of extinction has been modelled. It is shown that to be consistent with both the observations of the density of the core at a scale of 1.5 x 10(17) cm and the extinction derived from the near-IR colors there must be a circumstellar hole of radius 10-100 A.U. for all density laws with exponents greater than 1.2. It is also shown that a component in addition to the star and circumstellar shell is necessary to match the observed spectrum of steep spectrum sources. Author

N87-15062*# Boston Univ., Mass.
THE BIRD: A PRESSURE-CONFINED EXPLOSION IN THE INTERSTELLAR MEDIUM Abstract Only
Adair P. Lane, Antony A. Stark (Bell Telephone Labs., Inc., Holmdel, N. J.), and David J. Helfand (Columbia Univ., New York.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 37 (For primary document see N87-15043 06-90)
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The non-thermal radio continuum source G5.3-1.0, mapped at 20 cm with the Very Large Array (VLA) by Becker and Helfand, has an unusual bird-like shape. In order to determine possible interaction of this source with adjacent cold gas, we have mapped this region in the J=1-0 line of CO using the AT and T Bell Laboratories 7m antenna and the FCRAO 14m antenna. The map shown contains 1859 spectra sampled on a 1.5 arcminute grid; each spectrum has an rms noise of 0.2 K in 1 MHz channels. There are several molecular clouds at different velocities along the line of sight. The outer regions of a previously unknown Giant Molecular Cloud (GMC) at l=4.7 deg., b=-0.85 deg., v=200 km s(-1) appears to be interacting with G5.3-10: the molecular cloud has a bird-shaped hole at the position of the continuum source, except that the brightest continuum point (the bird's head) appears to be embedded in the cloud. The velocity of this GMC indicates it is within 2 kpc of the galactic center. The morphology suggests that a supernova or other explosive event occurred near the outside of the GMC, in a region where (n) is approximately 300 cm(-3), and expanded into a region of lower density and pressure. The pressures, densities, and velocity gradients of molecular clouds near the galactic center are on average higher than those of clouds near the Sun. We therefore expect that Type II supernovae near the galactic center would be distorted by their interactions with their parent molecular clouds. M.G.

N87-15063*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GRAIN PROCESSES IN MASSIVE STAR FORMATION Abstract Only
Mark G. Wolfire and Joseph P. Cassinelli (Wisconsin Univ., Madison.) *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 38-39 (For primary

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Observational evidence suggests that stars greater than 100 M(solar) exist in the Galaxy and Large Magellanic Cloud (LMC), however classical star formation theory predicts stellar mass limits of only approx. 60 M(solar). A protostellar accretion flow consists of inflowing gas and dust. Grains are destroyed as they are near the central protostar creating a dust shell or cocoon. Radiation pressure acting on the grain can halt the inflow of material thereby limiting the amount of mass accumulated by the protostar. We first consider rather general constraints on the initial grain to gas ratio and mass accretion rates that permit inflow. We further constrain these results by constructing a numerical model. Radiative deceleration of grains and grain destruction processes are explicitly accounted for in an iterative solution of the radiation-hydrodynamic equations. Findings seem to suggest that star formation by spherical accretion requires rather extreme preconditioning of the grain and gas environment. M.G.

N87-15064*# Tata Inst. of Fundamental Research, Bombay (India).
LOWER MASS LIMIT OF AN EVOLVING INTERSTELLAR CLOUD AND CHEMISTRY IN AN EVOLVING OSCILLATORY CLOUD Abstract Only
S. P. Tarafdar *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 40 (For primary document see N87-15043 06-90)
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Simultaneous solution of the equation of motion, equation of state and energy equation including heating and cooling processes for interstellar medium gives for a collapsing cloud a lower mass limit which is significantly smaller than the Jeans mass for the same initial density. The clouds with higher mass than this limiting mass collapse whereas clouds with smaller than critical mass pass through a maximum central density giving apparently similar clouds (i.e., same Av, size and central density) at two different phases of its evolution (i.e., with different life time). Preliminary results of chemistry in such an evolving oscillatory cloud show significant difference in abundances of some of the molecules in two physically similar clouds with different life times. The problems of depletion and short life time of evolving clouds appear to be less severe in such an oscillatory cloud. Author

N87-15065*# Observatoire de Paris-Meudon (France).
JEANS CRITERION IN A TURBULENT MEDIUM Abstract Only
S. Bonazzola, E. Falgarone, J. Heyvaerts, M. Perault, and J. L. Puget *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 41 (For primary document see N87-15043 06-90)
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According to the classical Jeans analysis, all the molecular clouds of mass larger than a few 100 M(solar), size larger than about 1pc and kinetic temperature Tk less than 30K are gravitationally unstable. We have shown that in clouds supported by internal supersonic motions, local gravitational instabilities may appear within molecular clouds which are globally stable. The argument is threefold: (1) when the turbulent kinetic energy is included into the internal energy term, the virial equilibrium condition shows that molecular clouds such as those observed, which are gravitationally unstable according to the Jeans criterion, are indeed globally stable if supported by a turbulent velocity field of power spectrum steeper than 3; (2) 2D compressible hydrodynamical simulations show that a supersonic turbulent velocity field generates a turbulent pressure within clouds, the gradients of which stabilize the unstable scales (i.e., the largest scales and the cloud itself) against gravitational collapse; (3) an analysis similar to the Jeans approach but including the turbulent pressure gradient term, gives basically the same results as those given in (1). Clouds of mean density lower than a critical value are found to be stable even though more massive than their Jeans mass. In clouds of mean density larger than that critical value, the gravitational instability appears only over a range of scales smaller than the cloud size, the largest scales being stable. In practice, the observed mean densities are lower than this critical value: the observation of a small number of cores and stars of a few solar masses embedded in clouds of several hundred solar masses can only be understood in terms of small scale density fluctuations of large amplitude generated by the supersonic turbulence which would occasionally overtake the limit of gravitational stability. Author

N87-15066*# California Univ., Berkeley.
SPECTRAL EVOLUTION OF YOUNG STELLAR OBJECTS Abstract Only
Fred C. Adams *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 42 (For primary document see N87-15043 06-90)
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An evolutionary sequence, from protostars to pre-main-sequence stars, is suggested for the classification of young stellar objects. This sequence is derived by comparing the predictions of the theoretical models of Adams and Shu with the morphological classification scheme of Lada and Wilking. We first define the spectral index in the near- and mid-infrared, n is identical to d log(nu F sub nu)/d log nu, and then interpret the class of sources with negative spectral indices as protostars. The inferred mass infall rates for these objects are generally consistent with the measured gas temperatures of approx. 35 K in Ophiuchus, and of approx. 10 K in Taurus. Fitting the data requires us to adopt cloud rotation rates in Ophiuchus which are typically an order of magnitude greater than in Taurus, and we speculate on the mechanistic origin for this difference. Next, we consider a subclass of T Tauri stars with near- and mid-infrared excesses and positive or zero spectral indices. We find that the objects with the steeper indices can be understood as the post-infall products from the collapse of rotating cloud cores, where the infrared excesses arise from the simple reprocessing of visible stellar photons in optically thick but spatially thin disks. The sources with flatter spectra may require massive accretion disks. Given the existence of protostars and naked star/disk systems, there is a natural interpretation of another subclass of T Tauri stars, those with two peaks in their emergent spectral energy distributions. These are readily explained as intermediate cases in which dust envelopes still surround the stars and disks. Finally, we find that the theory can be extended to explain the spectral energy distribution of FU Orionis, a famous outburst source. Our model suggests that FU Orionis has a disk, but it offers no discrimination between the competing ideas that the outburst took place on the star or in the disk. Author

N87-15067*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
SUPERSHELLS AND PROPAGATING STAR FORMATION Abstract Only
M.-M. MacLow, R. McCray, and M. Kafatos (George Mason Univ., Fairfax, Va.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 43 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Correlated supernovae from an OB association can carve large cavities (greater than 100 pc) in the interstellar medium (ISM), and can punch holes completely through the disk of a spiral galaxy. Supernova remnant energy within such a cavity is thermalized before the shock reaches the supershell. Thus stellar wind theory may be used to model these superbubbles. We describe how the evolution of the superbubble depends on the density distribution of the galactic disk gas and the rate of supernovae in the OB association. At a radius of 100 to 300 pc, the supershell becomes gravitationally unstable, forming giant molecular clouds which are the sites for new star formation. This gravitational instability of the supershells provides a physical mechanism for propagating star formation and may account for the observation of bursts of star formation in galaxies. Author

N87-15068*# Arizona Univ., Tucson. Dept. of Planetary Sciences.
SIZE-DENSITY RELATIONS IN DARK CLOUDS: NON-LTE EFFECTS Abstract Only
Philip Maloney *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct.

1986 p 45-46 (For primary document see N87-15043 06-90)
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One of the major goals of molecular astronomy has been to understand the physics and dynamics of dense interstellar clouds. Because the interpretation of observations of giant molecular clouds is complicated by their very complex structure and the dynamical effects of star formation, a number of studies have concentrated on dark clouds. Leung, Kutner and Mead (1982) (hereafter LKM) and Myers (1983), in studies of CO and NH3 emission, concluded that dark clouds exhibit significant correlations between linewidth and cloud radius of the form delta v varies as R(0.5) and between mean density and radius of the form n varies as R(-1), as originally suggested by Larson (1981). This result suggests that these objects are in virial equilibrium. However, the mean densities inferred from the CO data of LKM are based on an local thermodynamic equilibrium (LTE) analysis of their 13CO data. At the very low mean densities inferred by LKM for the larger clouds in their samples, the assumption of LTE becomes very questionable. As most of the range in R in the density-size correlation comes from the clouds observed in CO, it seems worthwhile to examine how non-LTE effects will influence the derived densities. One way to assess the validity of LTE-derived densities is to construct cloud models and then to interpret them in the same way as the observed data. Microturbulent models of inhomogeneous clouds of varying central concentration with the linewidth-size and mean density-size relations found by Myers show sub-thermal excitation of the 13CO line in the larger clouds, with the result that LTE analysis considerbly underestimates the actual column density. A more general approach which doesn't require detailed modeling of the clouds is to consider whether the observed T sub R*(13CO) /T sub R*(12CO) ratios in the clouds studied by LKM are in the range where the LTE-derived optical depths (and hence column densities) can be seriously in error due to sub-thermal excitation of the 13CO molecule. M.G.

N87-15069*# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).
UNSTABLE 06.5f?p STAR HD 148937 AND ITS INTERSTELLAR ENVIRONMENT Abstract Only
Claus Leitherer and Carlos Chavarria-K. *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 47-48 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The massive, early-type star HD 148937 (spectral type 06.5?p) is surrounded by a unique set of nebulosities. A spherically symmetric Stromgren sphere (Radius approx. - 25 pc), an ellipsoidal filamentary nebulosity (semimajor axis approx. - 5 pc) interpreted as a stellar-wind-blown shell, and a bipolar nebular complex (semimajor axis approx. - 1 pc) with HD 148937 located in the apparent center of symmetry. Observations of these nebulosities are reported (narrow-band charge coupled devices imaging, image dissector scanner (IDS) spectrophotometry, high resolution spectroscopy) in an attempt to establish a consistent model of HD 148937 and its nebulosities. Author

N87-15070*# Rice Univ., Houston, Tex.
TURBULENCE IN HII REGIONS Abstract Only
C. R. ODell *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 49-50 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

It has been known for many decades that the Reynolds number in HII regions must be very high and that the corresponding fine scale flow must be turbulent. Even though the theoretical relation between turbulent element separation and random velocity was derived by Kolmogoroff over forty years ago, there have been only a few attempts to test this theory and its corresponding assumptions. An attempt by Munch for M42 with marginal velocity resolution lead to ambiguous results, although more recent studies by Jean Rene Roy and his colleagues have been more credible. The internal velocities of a number of HII regions were systematically studied and the theory was tested with considerable certainty. The results should be important for the determination of the energy balance of HII regions and the relation of small scale motion to the process of star formation. Author

N87-15071*# Bell Telephone Labs., Inc., Holmdel, N. J.
CO NEAR THE PLEIADES: ENCOUNTER OF A STAR CLUSTER WITH A SMALL MOLECULAR CLOUD Abstract Only
John Bally and Richard E. White (Smith Coll., Northampton, Mass.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 51-52 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Although there is a large amount of interstellar matter near the Pleiades star cluster, the observed dust and gas is not a remnant of the placental molecular cloud from which the star cluster was formed. Carbon monoxide (CO) associated with the visible reflection nebulae was discovered by Cohen (1975). Its radial velocity differs from that of the cluster by many times the cluster escape velocity, which implies that the cloud-cluster association is the result of a chance encounter. This circumstance and the proximity of the Pleiades to the sun creates an unique opportunity for study of interstellar processes at high spatial resolution. To study the molecular component of the gas, a 1.7 square degree field was mapped with the AT&T Bell Laboratories 7-meter antenna (1.7' beam) on a 1' grid in the J=1.0 C(12)O line, obtaining over 6,000 spectra with 50 kHz resolution. The cloud core was mapped in the J=1-0 line of C(13)O. Further observations include an unsuccessful search for CS (J=2-1) at AT&T BL, and some C(12)O J=2-1 spectra obtained at the Millimeter Wave Observatory of the University of Texas. Author

N87-15072*# Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de AStronomia.
OPTICAL OBSERVATIONS OF VERY LOW IONIZATION HII REGIONS IN THE LARGE MAGELLANIC CLOUD Abstract Only
Miriam Pena, Maria T. Ruiz (Chile Univ., Santiago.), and Monica Rubio *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 53 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Several very low ionization isolated HII regions were detected on a prism-objective plate of the Large Magellanic Cloud. Most of the objects show a very weak (OIII) lambda 5007 emission line and, on the other hand the (OII) lambda 6584 doublets are very intense. This kind of objects seem to be ideal in order to determine accurate N and O abundance, avoiding the use of large ionization correction factors in the N abundance determination. Spectrophotometric observations of these regions were carried out with the 4 m telescope and the 2-D Frutti spectrograph at Cerro Tololo, and with the 1.52 m and the Image Dissector Scanner (IDS) at La Silla, ESO. The wavelength range lambda lambda 3700 to 7000 A was covered. Calibrated fluxes of the emission lines detected were measured, and from these data preliminary results of physical conditions of the gas as well as some ionic abundances were derived. Comparisons of the observations with ionization structure models show that the effective temperatures of the ionizing stars are less than 35,000 K. Possible abundances gradients across the large megallanic cloud are discussed. Author

N87-15073*# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Service d'Astrophysique.
NON-EQUILIBRIUM IONIZATION AROUND CLOUDS EVAPORATING IN THE INTERSTELLAR MEDIUM Abstract Only
J. Ballet, J. F. Luciani (Ecole Polytechnique, Palaiseau (France).), and P. Mora *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 55-56 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

It is of prime importance for global models of the interstellar medium to know whether dense clouds do or do not evaporate in the hot coronal gas. The rate of mass exchanges between phases

depends very much on that. McKee and Ostriker's model, for instance, assumes that evaporation is important enough to control the expansion of supernova remnants, and that mass loss obeys the law derived by Cowie and McKee. In fact, the geometry of the magnetic field is nearly unknown, and it might totally inhibit evaporation, if the clouds are not regularly connected to the hot gas. Up to now, the only test of the theory is the U.V. observation (by the Copernicus and IUE satellites) of absorption lines of ions such as OVI or NV, that exist at temperatures of a few 100,000 K typical of transition layers around evaporating clouds. Other means of testing the theory are discussed. Author

N87-15074*# Texas Univ., Austin. Dept. of Astronomy.
NEAR-INFRARED SPECTROSCOPY OF PLANETARY NEBULAE: HOW STRONG IS THE H2 EMISSION? Abstract Only
H. L. Dinerstein, J. Carr, P. M. Harvey, and D. F. Lester *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 57-58 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

In an effort to understand the systematics of the H2 emission from planetary nebulae, a program of near-infared spectroscopy using the University of Texas infrared reticon spectrometer was started. This instrument has a 1x32 element InSb photodiode array as a detector. All of the observations reported were made on the McDonald Observatory 2.7 m telescope, with spectra resolving power lambda/delta lambda = 600. The spectral coverage allows the measurement strengths of Brackett gamma He I 2.113 microns, HE II 2.189 microns and the v = 1=0 S(1) line of H2 at 2.122 microns. One of the most important advantages of this instrument is that we are able to resolve H2 from the adjacent He I line. Most previous observations of planetaries have been made at spectral resolving powers of about 100, which blend these lines. The contribution of the He I line has generally been dismissed as being unimportant, but we show that this may not be valid. Our higher resolving power also improves the line-to-continuum contrast; in some cases, the continuum is the limiting factor in detecting faint lines. E.R.

N87-15075*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED SPECTRA OF WC10 PLANETARY NEBULAE NUCLEI Abstract Only
D. H. Wooden, M. Cohen, J. D. Bregman, F. C. Witteborn, D. M. Rank, L. J. Allamandola, and G. G. M. Tielens *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 59-60 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The 5.2 to 8.0 micron spectra are presented for two planetary nebulae nuclei Hen1044 (He2-113) and CPD-56 8032. The unidentified infrared (UIR) emission bands at 6.2 microns, 6.9 microns, 7.7 microns are present in the spectra of Hen1044 and in CPD-56 8032, and the 8.6 micron band is present in the long wavelength shoulder of the 7.7 micron band in the spectrum of CPD-56 8032. The 8 to 13 micron spectra of these two stars by Aitken et. al. clearly show the presence of the 8.6 micron band in He2-113 while weakly resolving this feature in the spectra of CPD-56 8032. In their spectra the 11.3 micron band is also clearly detected in both objects. The 6.2 micron and 7.7 micron bands are characteristic of the infrared active C-C stretching modes in polycyclic aromatic hydrocarbons (PAHs); the 3.3 micron, 8.6 micron, and 11.3 micron bands are respectively assigned to the in-plane stretching mode, the in-plane bending mode, and the out-of-plane bending mode of the aromatic CH bond. The weak 6.9 micron emission feature is attributed to the UIR spectrum by Bregman et. al. The IRAS LRS spectra of He2-113 (IRAS 14562-5406) and CPD-56 8032 (IRAS 17047-5650) are presented. Cohen et. al. identify the broad plateau from 11.3 to 13.0 microns in the spectrum of He2-113 with increased hydrogenation of PAHs. This broad plateau is not seen in the LRS spectrum of CPD-56 8032. Also, He2-113 has greater infrared excess emission in the 17-22 micron region than does CPD-56 8032. Author

N87-15076*# California Univ., Los Angeles.
PLANETARY NEBULAE AND THE INTERSTELLAR MEDIUM Abstract Only
Lawrence H. Aller *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 61-62 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

In addition to available published data on planetary nebulae (PN), some 40 objects largely concentrated towards the galactic center and anticenter regions were included. All were observed with the Lick 3(sup m) telescope and image tube scanner. Abundances of C, N, O, Ne, Cl, and Ar were determined by a procedure in which theoretical models were used to obtain ionization correction factors (ICF). Of the 106 PN, 66 are N-rich and 40 are N-poor. There appear to be no significant differences between the average compositions in the solar neighborhood and the average taken over the entire observable portion of the galaxy. B.G.

N87-15077*# California Inst. of Tech., Pasadena. Radio Observatory.
HIGH-RESOLUTION MAPPING OF MASS LOSS FROM HIGHLY EVOLVED CARBON STARS Abstract Only
Roger Ball *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 63-64 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The molecular component of the mass outflow at high resolution was mapped with the Owens Valley Millimeter-Wave Interferometer in two well-known objects, CRL 2688 and CIT 6. Interferometric observations of a pair of carbon stars which are evolving toward the planetary nebula stage have revealed evidence of episodic, nonspherically symmetric mass loss, and may lead to a fuller understanding of shielding properties of the dust grains involved in these flows. B.G.

N87-15078*# Arizona Univ., Tucson.
MASS RETURN TO THE INTERSTELLAR MEDIUM FROM HIGHLY-EVOLVED CARBON STARS Abstract Only
W. B. Latter, Harley A. Thronson, Jr. (Wyoming Univ., Laramie.), Perry Hacking, J. Bally (Bell Telephone Labs. Inc., Holmdel, N. J.), and J. Black *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 65-66 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Data produced by the Infrared Astronomy Satellite (IRAS) was surveyed at the mid- and far-infrared wavelengths. Visually-identified carbon stars in the 12/25/60 micron color-color diagram were plotted, along with the location of a number of mass-losing stars that lie near the location of the carbon stars, but are not carbon rich. The final sample consisted of 619 objects, which were estimated to be contaminated by 7 % noncarbon-rich objects. The mass return rate was estimated for all evolved circumstellar envelopes. The IRAS Point Source Catalog (PSC) was also searched for the entire class of stars with excess emission. Mass-loss rates, lifetimes, and birthrates for evolved stars were also estimated. B.G.

N87-15079*# Illinois Univ., Urbana.
THE CLUMPY CIRCUMSTELLAR MEDIUM AROUND YOUNG SUPERNOVA REMNANTS Abstract Only
John R. Dickel, Eric M. Jones (Los Alamos National Lab., N. Mex.), and Jean A. Eilek (New Mexico Inst. of Mining and Technology, Socorro.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 67-68 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Each of the youngest supernova remnants known in the Milky Way, Cas A, Kepler's SNR, and Tycho's SNR, shows a different morphological structure caused by different conditions in the progenitor stars and their surroundings. In all three cases, however, the observed shells have a thickness of about 1/4 the radius, a sharp outer edge, and significant brightness irregularities. These

features require that the circumstellar medium be highly clumped. To investigate the phenomenon, models of the expansion have been constructed using a one-dimensional spherical hydrodynamic code. As a supernova shock moves down the external density gradient of the star, material behind the shock begins to go into free expansion. Then as surrounding material is encountered a reverse shock moving back into the ejectum will be formed. Until the expansion has swept up about eight times the ejected mass when the situation can be considered as a point explosion in its surroundings, the dynamics are controlled by conditions between the shocks. The region is also where the synchrotron radio emission from relativistic electrons trapped in magnetic fields arises. Initial particles and fields are accelerated and amplified by eddy motion at the interface between the ejected and swept-up material and at the boundaries of clumps. Polarimetry shows that these SNR have a net radial orientation of their magnetic fields apparently from stretching by Rayleigh-Taylor instabilities at the contact surfaces. Without clumps the observed shell is much too narrow and steep on the inside. Author

N87-15080*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
THE MOLECULAR GAS IN THE SUPERNOVA REMNANT IC443 Abstract Only
Y.-L. Huang, R. L. Dickman, and R. L. Snell *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 69-70 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Although a few highly perturbed regions characterized by gas motions with velocities larger than 20 km/s have been discovered during the last several years in the supernova remnant (SNR) IC 443, the nature of these perturbed clumps and their relationship to the quiescent molecular gas near the SNR remains unknown. In part, this is due to a lack of large-scale, high angular resolution observations. Therefore, a systematic survey of this SNR in the CO (J=1 yields 0) line has been conducted, covering a roughly 50' x 50' region spaced by 2'. The observations were made with the 14 m telescope of the Five College Radio Astronomy Observatory (FCRAO), which has a resolution of 45' and a single sideband receiver temperature of 200 K at 2.6 mm wavelength. Five new clumps were discovered, bringing the total number of known perturbed regions to eight. To study the physical structure of these clumps in more detail, more complete maps of the clumps have been made in both the CO(J=1 yields 0) and (J=2 yields 1) transitions with the FCRAO telescope. These maps show that the extent of perturbed gas in a typical clump is several arcmin, or a few pc at a distance of 1.5 kpc. Author

N87-15081*# Durham Univ. (England). Dept. of Physics.
OBSERVATIONAL DISCRIMINATION BETWEEN MODES OF SHOCK PROPAGATION IN INTERSTELLAR CLOUDS: PREDICTIONS OF CH+ AND SH+ COLUMN DENSITIES IN DIFFUSE CLOUDS Abstract Only
D. R. Flower, G. Pineau desForets (Observatoire de Paris-Meudon (France).), E. Roueff, and T. W. Hartquist (Max-Planck-Inst. fuer Extraterrestrische Physik, Munich (West Germany).) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 71-72 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Considerable effort in recent years has been devoted to the study of shocks in the diffuse interstellar medium. This work has been motivated partly by the observations of rotationally excited states of H2, and partly by the realization that species such as CH(+), OH and H2O might be formed preferentially in hot, post-shock gas. The problem of CH(+) and the difficulties encountered when trying to explain the high column densities, observed along lines of sight to certain hot stars, have been reviewed earlier. The importance of a transverse magnetic field on the structure of an interstellar shock was also demonstrated earlier. Transverse magnetic fields above a critical strength give rise to an acceleration zone or precursor, in which the parameters on the flow vary continuously. Chemical reactions, which change the degree of ionization of the gas, also modify the structure of the shock considerably. Recent work has shown that large column densities of CH(+) can be produced in magnetohydrodynamic shock models. Shock speeds U sub s approx. = 10 km/s and initial magnetic field strengths of a few micro G are sufficient to produce ion-neutral drift velocities which can drive the endothermic C(+)(H2,H)CH(+) reaction. It was also shown that single-fluid hydrodynamic models do not generate sufficiently large column densities of CH(+) unless unacceptably high shock velocities (u sub s approx. 20 km/s) are assumed in the models. Thus, the observed column densities of CH(+) provide a constraint on the mode of shock propagation in diffuse clouds. More precisely, they determine a lower limit to the ion-neutral drift velocity. Author

N87-15082*# Bell Telephone Labs., Inc., Holmdel, N. J.
A CS J = 2 > 1 SURVEY OF THE GALACTIC CENTER REGION Abstract Only
Antony A. Stark, John Bally, Mark Dragovan, and Robert W. Wilson *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 73-74 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

A CS map of the galactic center region is presented consisting of 15,000 spectra covering -1 deg. less than 3. deg. 6 min., -0 deg.4 min. less than b less than 0 deg. 4 min., each having an rms noise of 0.15 K in 1 MHz filters. CS is a high-excitation molecule, meaning that it is excited into emission only when the ambient density is less than n much greater than or approx. 2 x 10 to the 4th power/cu cm CS emission in the inner 2 deg. of the galaxy is nearly as pervasive as CO emission, in stark contrast to the outer galaxy where CS emission is confined to cloud cores. Galactic center clouds are on average much more dense than outer Galaxy clouds. This can be understood as a necessary consequence of the strong tidal stresses in the inner galaxy. Author

N87-15083*# California Univ., Berkeley. Dept. of Physics.
APERTURE SYNTHESIS OBSERVATIONS OF THE MOLECULAR RING IN THE GALACTIC CENTER Abstract Only
R. Guesten, R. Genzel, M. C. H. Wright, D. T. Jaffe, and J. Stutzki *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 75-76 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Reported are 88 GHz aperture synthesis observations of HCN J=1 yields 0 emission and absorption in the central 5 pc of the Galaxy. The data, taken by the Hat Creek mm-interferometer at 5' to 10' spatial and 4 km/s spectral resolution, show a complete, clumpy ring of molecular gas surrounding the ionized central 2 pc of the Galaxy. The ring is the inner edge of a larger disk extending to about 5 pc. Comparison with sub-mm line data suggests that the HCN 1-0 line is slightly optically thick and originates in subthermally populated gas. The clumpy line emission distribution reflects a combination of hydrogen volume and column density variations. The new data clearly show a close physical relation between the molecular and the ionized gas in the central cavity. The western arc appears to be the ionized inner surface of the molecular ring, and the northern arm and bar may be streamers of ionized gas falling from the ring toward the center. The dominant large scale velocity pattern of the majority of the molecular gas in the inner 5 pc is rotation. No overall radial motion of the ring greater than about 20 km/s is apparent. The rotation is perturbed in several ways; (1) there is a very large local velocity dispersion, (2) the ring shows changes in position angle and inclination (warps), (3) there is a bright, redshifted cloud which appears to be located in the western part of the ring but does not participate in the rotation. These characteristics and the high degree of clumpiness indicate a non-equilibrium configuration of short (less than or approx. 10 to the 4th power to 10 to the 5th power y) dynamical lifetime. The warping and tilting of the structure and the short dynamical lifetime make an accurate determination of equilibrium rotation velocity uncertain. Author

N87-15084*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
IUE ABSORPTION STUDIES OF BROAD- AND NARROW-LINE GAS IN SEYFERT GALAXIES Abstract Only
G. Mark Voit, J. Michael Shull, and Mitchell C. Begelman *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 77-78 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The interstellar medium of a galaxy containing an active nucleus may be profoundly affected by the high energy (X-ray, EUV) continuum flux emanating from the central source. The energetic source may photoionize the interstellar medium out to several kiloparsecs, thereby creating a global H II region. The International Ultraviolet Explorer (IUE) satellite has attempted to observe in several Seyfert galaxies (NGC 3516, NGC 4151, NGC 1068, 3C 120) the narrow absorption lines expected from such global H II regions. Instead, in two of the galaxies (NGC 3516, NGC 4151) broad, variable absorption lines at C IV lambda 1550, N V lambda 1240, and Si IV lambda 1400 were found, as well as weaker absorption features at O I lambda 1302 and C II lambda 1335. These features swamp any possible global H II region absorption. Such broad absorption features have previously been observed in IUE data, but their origin is still not well understood. Author

N87-15085*# Minnesota Univ., Minneapolis.
COLD ATOMIC HYDROGEN IN THE INNER GALAXY Abstract Only
John M. Dickey and R. W. Garwood *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 79-80 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The VLA is used to measure 21 cm absorption in directions with the absolute value of b less than 1 deg., the absolute value of 1 less than 25 deg. to probe the cool atomic gas in the inner galaxy. Abundant H I absorption is detected; typical lines are deep and narrow, sometimes blending in velocity with adjacent features. Unlike 21 cm emission not all allowed velocities are covered: large portions of the l-v diagram are optically thin. Although not similar to H I emission, the absorption shows a striking correspondence with CO emission in the inner galaxy: essentially every strong feature detected in one survey is seen in the other. The provisional conclusion is that in the inner galaxy most cool atomic gas is associated with molecular cloud complexes. There are few or no cold atomic clouds devoid of molecules in the inner galaxy, although these are common in the outer galaxy. Author

N87-15086*# Colorado Univ., Boulder.
NEUTRAL HYDROGEN CLOUD DISTANCES AND THE STRENGTH OF THE INTERSTELLAR MAGNETC FIELD
Gerrit L. Verschuur *In* NASA. Ames Research Center Summer School on Intestellar Processes: Abstracts of Contributed Papers Oct. 1986 p 81-91 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

If HI clouds exist in pressure equilibrium in an environment where gas pressure is a function of z-distance and if HI cloud density is a function of z-distance, it can be shown that a quantity called the Virial Measure is a function of z-distance. The Virial Measure is that distance at which a cloud would be in gravitational equilibrium if its internal kinetic temperature is indicated by profile linewidth. The Virial Measure is derived from observed cloud parameters and has been calibrated for clouds of known distance so that it can be used to determine the distance to other HI clouds. The magnitude of various terms in the virial equation can thus be derived for several hundred HI clouds. It is demonstrated that the strength of the interstellar magnetic field is a function of z-distance. Author

N87-15087*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MOLECULAR CONTENT OF THE NEARBY GALAXY FROM IRAS AND HI OBSERVATIONS Abstract Only
David Bazell (Applied Research Corp., Landover, Md.) and F. X. Desert *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 93-94 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Because infrared emission is a very good tracer of mass at high latitudes, by combining it with HI observations it provides a convenient though indirect way of observing the spatial distribution of molecular material. Moreover, these observations will premit placing limits on the fraction of total infrared luminosity emitted by dust associated with molecular and atomic hydrogen clouds. A preliminary result from the study of the correlation between HI column density and 100 micron infrared flux density as measured by the IRAS satellite is reported. The ratio F100/W(HI) = R has an average value of roughty 17 KJy/sr/(K km/s) over the whole sky. Bright regions in the FIR such as the Galactic plane and HII regions are excluded from the data. The histogram of the number of pixels vs R has a strong peak near 17 (same units as before) and is asymmetric about this mean value, having a tail at higher values of R. This basic shape is fairly independent of the region of the sky we observe. The peak confirms the general correlation between infrared emission and HI column density reported previously. One way to explain the shape of the distribution is to assume a constant dust to gas mass ratio and a constant interstellar radiation field and associate points in the tail with molecular clouds. In this case the ratio R is higher for points in the tail because it does not account for the column density of molecular hydrogen. Author

N87-15088*# Wisconsin Univ., Madison.
MILKY WAY HALO GAS KINEMATICS Abstract Only
Laura Danly *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 95-96 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Measurements of high resolution, short wavelength absorption data taken by IUE toward high latitude O and B stars are presented in a discussion of the large scale kinematic properties of Milky Way Halo gas. An analysis of these data demonstrates that: (1) the obsrved absorption widths (FWHM) of Si II are very large, ranging up to 150 Km/s for the most distant halo star; this is much larger than is generally appreciated from optical data; (2) the absorption is observed to be systematically negative in radial velocity, indicating that cool material is, on the whole, flowing toward the disk of the galaxy; (3) there is some evidence for asymmetry between the northern and southern galactic hemispheres, in accordance with the HI 21 cm data toward the galactic poles; (4) low column density gas with highly negative radial LSR velocity (V less than -70 km/s) can be found toward stars beyond 1-3 kpc in the northern galactic hemisphere in all four quadrants of galactic longitude; and (5) only the profiles toward stars in the direction of known high velocity HI features show a clear two component structure. Author

N87-15089*# Naval Research Lab., Washington, D. C. Center for Space Research.
IRAS OBSERVATIONS OF GIANT MOLECULAR CLOUDS IN THE MILKY WAY Abstract Only
David Mozurkewich and Harley A. Thronson, Jr. *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 97-98 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The IRAS data base has been used to study infrared radiation from molecular clouds in our galaxy. The sample of clouds was restricted to those with reliably determined molecular masses from large area, multi-isotope CO maps. They were normalized to X(CO-13)= 2x10 to the -6. Flux densities at 60 microns and 100 microns were determined by integrating the flux density within rectangles drawn on the sky flux plates after subtracting a suitable background. The rectangles were chosen to be coextensive with the areas mapped in CO. Color corrections were made and luminosites calculated by assuming the optical depths were proportional to frequency. The flux densities were converted to

dust masses with a value for 4a rho/3Q = .04 g/cm at 100 microns. Author

N87-15090*# Arizona Univ., Tucson.
SPIRAL ARMS AND MASSIVE STAR FORMATION: ANALYSIS OF THE CO FACE-ON PICTURES OF THE GALAXY Abstract Only
D. P. Clemens, D. B. Sanders (California Inst. of Tech., Pasadena), and N. Z. Scoville *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 99-100 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The face-on distribution of molecular gas in the first Galactic quadrant, derived from the Massachusetts-Stony Brook Galactic Plane CO Survey, was compared to the Galactic distribution of giant radio HII regions. The HII regions were found to preferentially select gas regions of higher than average density (more than twice the mean) and showed a strong correlation with the second power of the gas density. Systematic effects were tested with a Monte Carlo simulated HII region distribution and found to be negligible. The 135 HII regions were selected from the radio catalogs of Downes et at. (1980) and Wink et al. (1982). The HII regions were required to be within the CO survey 1 and b limits, within the solar circle, and not part of the 3 kpc expanding arm. The velocities of the HII regions were tabulated by the catalog authors and obvious associations with known objects and H2CO absorptions were used by them to assign distances. The distance assignments were here grouped into two categories; (1) those HII regions with definite distance assignments (85 objects); and (2) those HII regions with less secure distance assignments and those for which no near-far assignment was possible (50 objects).
Author

N87-15091*# Virginia Univ., Charlottesville.
THE VELOCITY DISPERSION OF THE GIANT MOLECULE CLOUDS: A VISCOUS ORIGIN Abstract Only
Chanda J. Jog and Jeremiah P. Ostriker (Princeton Univ., N. J.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 101-102 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The observations of interstellar cloud motion show that the cloud velocity dispersion is nearly constant, to within a factor of 2, for clouds covering at least three orders of magnitude in mass. For example, the Giant Molecular Cloud (GMC) with typical masses of approx 5 x 10 to the 5th power solar masses have a one-dimensional planar, cloud-cloud, random velocity dispersion of approx 3-7 km/s. The HI clouds, of approx. 400 solar masses each, on the other hand, have a typical one-dimensional velocity dispersion of approx 6 km/s. Clearly, the clouds are not in kinetic energy equipartion. The GMC spatial distribution in the galactic disk is not that of an isolated, 3-D system; rather, the GMCs exhibit a very thin disk (approx nearly a monolayer) distribution; with the ratio of the diameter of a typical GMC to the vertical scale-height of the GMC distribution being approx 50 pc/150 pc = 0.3. The supernova shocks, which can accelerate the low mass clouds, are extremely ineffective in accelerating the GMCs because of the much larger mass/area ratio for the GMCs. The above points suggest that the GMCs do not constitute an isolated, 3-D system - rather, they indicate that the dynamics of the GMCs is mainly determined by the fact that they are located in a differentially rotating galactic disk, and that, as for particles in planetary rings, viscosity is the primary energy input. Specifically, it is proposed that gravitational scattering of the massive clouds off each other in the differentially rotating galactic disk constitutes an effective gravitational viscosity, which causes an increase in the random kinetic energy of the GMCs at the expense of their ordered, rotational kinetic energy. Author

N87-15092*# Virginia Univ., Charlottesville. Inst. for Theoretical Astronomy.
LOCAL INTERSTELLAR GASDYNAMICAL STABILITY IN SPIRAL ARM FLOW
Steven A. Balbus *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 103-104 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The stability of two-dimensional interstellar gas flow passing through a spiral potential has been investigated. The background flow is assumed to move in a tightly wound potential, which may be regarded as external or self-generated. The unperturbed flow, which may be time dependent, is self-gravitating and satisfies the Roberts equations of motion. A polytropic, single-fluid assumption has been used. Magnetic effects are not considered. The motivation behind this work is to try to understand how much of the diversity of spiral arm morphology can be understood by large scale gas dynamical processes alone. To this end, it is suggested that spurring and feathering, and forming molecular cloud complexes may be closely related in the sense of having dynamically similar origins. Author

N87-15093*# Wyoming Univ., Laramie. Infrared Observatory.
THE (32)S/(33)S ABUNDANCE AS A FUNCTION OF GALACTOCENTRIC RADIUS IN THE MILKY WAY Abstract Only
Matthew A. Greenhouse and Harley A. Thronson, Jr. *In* NASA. Ames Research Center Summer School on Instellar Processes: Abstracts of Contributed Papers Oct. 1986 p 105-106 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Astration of heavy elements by the stars of the Milky Way forms a fossil record which may preserve spacial distribution of the mass function for the stars in the galaxy. Sulfur is among the last common element for which the relative abundance of its various isotopes have yet to be completely measured within our galaxy. Explosive oxygen burning in massive stars is thought to be the process which dominates sulfur production within stars. There models predict that the various isotopes (S-32, S-33, S-34) are formed in relative abundance which depend strongly upon the mass of the parent star. This relative abundance is thought to be unaffected by subsequent stellar procesing since all important sinks of sulfur destroy it without regard for isotopic form. Hence the spacial variation of the mass function (MF) can be studied by measuring the abundance variation of sulfur isotopes in the galaxy provided that the product yields for these isotopes are known accurately as a function of stellar mass. Author

N87-15094*# Arecibo Ionospheric Observatory, Puerto Rico.
IS OH ABUNDANCE ENHANCED IN TIDALLY DISTORTED GALAXIES? Abstract Only
Joan T. Schmelz *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 107 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

An extensive survey of 240 galaxies for hydroxyl absorption has been completed using the Arecibo Observatory. These galaxies were used to compile a sample to test for statistical correlations between the optical depth of the 1667 MHz hydroxyl line and various parameters of the parent galaxy. To be included in the sample, the radio flux density of the galaxy at 1667 MHz had to be between 20 mjy and 1000 mjy and the galactic declination between 0 and 38 deg. Since this sample contains mainly non-detections, statistical methods for astronomical data with upper limits as previously described were used to obtain correlation and regression information. Preliminary studies indicate a strong correlation between OH optical depth and infrared to blue luminosity ratio (L sub IR/L sub B), where the infrared data were obtained from the Cataloged Galaxies and Quasars Observed in the IRAS Survey. A second correlation is seen between the optical depth of the 1667 MHz line and galactic type, where a number from 1 to 15 (Elliptical to peculiar, distorted, or interacting) has been assigned to each galaxy. So, stable, isolated galaxies tend not to have detectable hydroxyl. On the other hand, galaxies with more gas and dust, galaxies with a more peculiar or distorted appearance, and galaxies which are more tidally interacting tend to have much more detectable OH. These findings could indicate that these dusty,

peculiar, distorted, and interacting galaxies could be the site of large amounts of shocked material where OH is likely to form. Hence, the hydroxyl abundance could be enhanced in these regions of shocked material making the detection of OH in these tidally distorted galaxies much more likely. Author

N87-15095*# Max-Planck-Inst. fuer Radioastronomie, Bonn (West Germany).

6 CM OH ABSORPTION IN MEGAMASER GALAXIES Abstract Only

C. Henkel, R. Guesten, and W. Baan (Arecibo Ionospheric Observatory, Puerto Rico) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 108 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Absorption in the 2Pi sub 1/2 J = 1/2 Lambda doublet transitions of OH, 182 K above the ground state, is detected in the megamaser galaxies IC 4553 (Arp 220), MK 231, MK 273, MGC 3690, and IRAS 17208-0014. The 4660, 4751, and 4766 MHz lines have intensity ratios moderately deviating from the LTE values (1:2:1). The OH rotational temperatures appear to be close to the temperature of the dust, approx. 60 K. The common characteristics of these galaxies (absence of 6 cm inversion, the optical depths, the infrared properties, the systematic trends in the line parameters, and the rotational temperatures) all suggest that the same pump process is responsible for the 18 cm line inversion in the five megamaser sources. The inversion is probably not due to an excitation mechanism involving collisions with HI or H2. While excitation via photodissociation of H2O cannot entirely be ruled out, the most likely mechanism is considered to be to be a combination of the intense FIR field (populating higher excited OH rotational states) and the non-thermal radiation from the nuclei of the parent galaxies (affecting the excitation within the Lambda -doublets). According to an LVG model of the OH excitation of IC4553, the OH-cloud(s) have to be located close, within 200 to 300 pc, to the center of the galaxy. The excitation of the individual 18 cm lines depends critically on the effective background radiation field and hence on the galactocentric distance of the masing clump. With increasing distance first the 1720 MHz and then the 18 cm main line inversion is quenched, while 1612 MHz inversion is obtained up to approx. 600 pc. The 1612 MHz satellite line is predicted to be more intense than the 1720 MHz line. A critical test for our excitation model is to observe the 2 Pi 3/2 J = 5/2 Lambda-doublet transitions which are predicted to be detectable in absorption. Author

N87-15096*# Arizona Univ., Tucson.

MOLECULAR HYDROGEN IN THE YOUNG STARBURST IN NGC 253 Abstract Only

G. H. Rieke, M. J. Lebofsky, and C. E. Walker *In* NASA. Ames Research Center Summer School on Interstellar Processes; Abstracts of Contributed Papers Oct. 1986 p 109 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Shocked molecular hydrogen has been observed around the nucleus of the nearby galaxy, NGC 253. This galaxy has a relatively modest luminosity (approx. 3 x 10 to the 10th power solar luminosities) and appears to have no distortions or companions that would indicate a possible interaction. The energy of the galaxy appears to be derived primarily from a starburst. Thus, our observations have caused us to examine the starburst process in some detail to identify how the molecular hydrogen is excited. It is proposed that the molecular hydrogen emission is produced by collisions of dense molecular clouds accelerated by supernovae explosions. Within the nucleus, this process occurs early in the life of the starbust. This suggest a sequence of nuclear starburst development; examples along this sequence from young to old would include NGC 253, M82, NGC 1097, and M31. Author

N87-15097*# Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Astronomia.

CHEMICAL EVOLUTION IN SPIRAL AND IRREGULAR GALAXIES Abstract Only

S. Torres-Peimbert *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 110 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

A brief review of models of chemical evolution of the interstellar medium in our galaxy and other galaxies is presented. These models predict the time variation and radial dependence of chemical composition in the gas as function of the input parameters; initial mass function, stellar birth rate, chemical composition of mass lost by stars during their evolution (yields), and the existence of large scale mass flows, like infall from the halo, outflow to the intergalactic medium or radial flows within a galaxy. At present there is a considerable wealth of observational data on the composition of HII regions in spiral and irregular galaxies to constrain the models. Comparisons are made between theory and the observed physical conditions. In particular, studies of helium, carbon, nitrogen and oxygen abundances are reviewed. In many molecular clouds the information we have on the amount of H2 is derived from the observed CO column density, and a standard CO/H2 ratio derived for the solar neighborhood. Chemical evolution models and the observed variations in O/H and N/O values, point out the need to include these results in a CO/H2 relation that should be, at least, a function of the O/H ratio. This aspect is also discussed. Author

N87-15098*# Ecole Normale Superieure, Paris (France). Groupe de Physique des Solides.

IDENTIFICATION OF POLYCYCLIC AROMATIC HYDROCARBONS Abstract Only

A. Leger and L. dHendecourt *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 111-112 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

The nature of the Very Small Grains evidenced by K. Sellgren (1985) is discussed. Thsir stability suggests that they are graphitic material and specifically Polycyclic Aromatic Hydrocarbons (PAHs). The expected infrared emission of a typical PAH, coronene, gives an impressive spectroscopic agreement with the five observed Unidentified IR Emission Features, leading to an unambiguous identification. Those PAHs are the most abundant organic molecules detected to date (f is approximately .00001). Author

N87-15099*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE POSSIBLE EXISTENCE OF INTERSTELLAR POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) IN COLLECTED INTERPLANETARY DUST PARTICLES Abstract Only

Scott A. Sandford *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 113-114 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Extraterrestrial dust particles which are 3 to 50 microns in size are routinely collected in the stratosphere and are now available for general laboratory study. These grains represent true Interplanetary Dust Particles (IDPs). Issues associated with the carbon containing components of IDPs which occur in a variety of physical forms, including amorphous mantles and matrix materials, are addressed. The observed properties of the hydrocarbon phase in IDPs are compared with those expected for polycyclic aromatic hydrocarbons (PAHs). B.G.

N87-15100*# Hawaii Univ., Honolulu. Inst. for Astronomy.

MORE INTERSTELLAR EMISSION FEATURES AT 3.3-3.6 MICROMETERS! Abstract Only

A. T. Tokunaga, T. Nagata, K. Sellgren, R. G. Smith, T. Onaka (Tokyo Univ., Japan), Y. Nakada, A Sakata (University of Electro-Communications, Tokyo, Japan), and S. Wada *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 115-116 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

The present data set consists of 3.20 to 3.55 micron spectra of HD44179, NGC 7027, BD+30 3639, and Elias 1 obtained with a cooled-grating array spectrometer (CGAS) at the NASA Infrared Telescope Facility. Emission features and details of the emission feature profiles are presented for high resolution spectra. Greater complexity is shown than might be expected. It is significant that the 3.29 micron feature has an invariant central wavelength, even at high resolution, and this strongly supports the case for a very specific substance or mixture of substances which is giving rise to this feature. B.G.

N87-15101*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RESOLUTION OF THE 7.7 MICROMETERS EMISSION FEATURE IN NGC 7027 Abstract Only

J. D. Bregman, L. J. Allamandola, A. G. G. M. Tielens, F. C. Witteborn, D. M. Rank (Lick Observatory, Santa Cruz, Calif.), and D. Wooden *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 117-118 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

The unidentified infrared (UIR) features are a group of emission bands observed in a variety of objects, which can be characterized as having moderate density gas (densities from 1000 to 1,000,000/cu.cm.) and a nearby ultraviolet source. The origin of the features is still uncertain, but the current evidence points to Polycyclic Aromatic Hydrocarbons (PAHs) as the source of the UIR features. Problems with identifying PAHs as the source of the UIR features are discussed. B.G.

N87-15102*# Ritter Observatory, Toledo, Ohio.

SPECTROSCOPY AND CCD-PHOTOGRAPHY OF EXTENDED RED EMISSION IN REFLECTION NEBULAE Abstract Only

Adolf N. Witt and Rudolph E. Schild (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 119-120 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Recent spectrographic studies of extended red emission (ERE) seen in the 0.6 to 0.9 micron spectral region in many reflection nebulae have shown fluorescence by amorphous hydrogenated carbon to be the most probable cause of the ERE. Spectrographic observations were performed on the nebulae NGC 2023 and NGC 7023, using the intensified Reticon scanner (IRS) of Kitt Peak National Observatory on the N0-2 0.9 mm telescope. Charge coupled device (CCD) images of NGC2023 and NGC 7023 were obtained with the CfA CCD detector on the 0.6 mm telescope of the Whipple Observatory. Results are discussed. B.G.

N87-15103*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

IRAS SURFACE BRIGHTNESS MAPS OF VISIBLE REFLECTION NEBULAE: EVIDENCE FOR NON-EQUILIBRIUM INFRARED EMISSION Abstract Only

Michael W. Castelaz, M. W. Werner, and K. Sellgren (Hawaii Univ., Honolulu) *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 121 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Surface brightness maps at 12, 25, 60, and 100 microns of 16 visible reflection nebulae were extracted from the Infrared Astronomy Satellite (IRAS) database. The maps were produced by coadding IRAS survey scans over areas centered on the illuminating stars, and have spatial resolutions of 0.9' x 4' at 12 and 25 microns, 1.8' x 4.5' at 60 microns, and 3.6' x 5' at 100 microns. Extended emission in the four IRAS bandpasses was detected in fourteen of the reflection nebulae. The IRAS data were used to measure the flux of the infrared emission associated with each source. The energy distributions show that the 12 micron flux is greater than the 25 micron flux in 11 of the nebulae, and the peak flux occurs in the 60 or 100 micron bandpass in all 16 nebular. The 60 and 100 micron flux can be approximated by blackbodies with temperatures between 30 and 50 K, consistent with temperatures expected from extrapolation of greybody fits to the 60 and 100 micron data. The excess 12 and 25 micron emission is attributed to a nonequilibrium process such as emission from thermal fluctuations of very small grains excited by single ultraviolet photons, or emission from polycyclic aromatic hydrocarbons (PAHs) excited by ultraviolet radiation. The common features of the energy distributions of the 16 reflection nebulae, also seen in the reflection nebulae associated with the Pleiades, suggest that PAHs or very small grains may be found in most reflection nebulae. Author

N87-15104*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INFRARED STUDIES OF SUPERNOVA REMNANTS WITH THE IRAS Abstract Only

E. Dwek, R. Petre, and A. Szymkowiak *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 123-124 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

A comparative study of the infrared and X-ray fluxes and morphologies of supernova remnants (SNR) can yield valuable information on their evolution and on their interaction with the smbient interstellar medium (ISM). Author

N87-15105*# Nicolaus Copernicus Univ., Torun (Poland).

UNUSUAL RELATIVE STRENGTHS OF THE DIFFUSE INTERSTELLAR BANDS IN SOME INTERSTELLAR DUST CLOUDS Abstract Only

J. Krelowski and G. A. H. Walker (British Columbia Univ., Vancouver) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 125-126 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

Some of the diffuse interstellar features (DIBs) in the spectra of certain stars at high galactic latitudes (1 is greater than 15 degrees) are unusually weak or absent while others have the strength expected for their color excess. In some cases the stars are probably reddened by single interstellar clouds. There appear to be three families of DIBs. The effects of these families are examined. The existance of the three families implies that at least three agents cause the DIBs and that the proportions of the agents or the physical conditions giving rise to the DIBs can vary from cloud to cloud. B.G.

N87-15106*# Hawaii Univ., Honolulu. Inst. for Astronomy.

MODERATE SPECTRAL RESOLUTION OBSERVATIONS OF 3 MICRON ABSORPTION FEATURES IN HIGHLY OBSCURED OBJECTS Abstract Only

Robert G. Smith, Kris Sellgren, and Alan T. Tokunaga *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 127-128 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

The 3 micron absorption spectra of sources seen in or behind molecular clouds generally show a variety of absorption features. Three separate absorptions are used to explain these features. The cooled-grating array spectrometer (CGAS) at the NASA Infrared Telescope Facility was used to obtain spectra of the late-type mass-loss star OH 0739-12 and the protostars MonR2 IRS-2 and IRS-3 (solid circles). The differences between the spectra are discussed. B.G.

N87-15107*# United Kingdom Infrared Telescope Unit, Hilo, Hawaii.

SOME RECENT INFRARED SPECTROSCOPY OF INTERSTELLAR PROCESSES Abstract Only

T. R. Geballe *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 129-130 (For primary document see N87-15043 06-90)

Avail: NTIS HC A10/MF A01 CSCL 03B

The potential which infrared spectroscopic techniques provide for studying interstellar process is demonstrated. Several examples

are given. The data were obtained at UKIRT, using its frequency-chopped Fabry-Perot spectrometer and its seven-channel cooled grating spectrometer. Author

N87-15108*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 3.1 MICROMETER ICE BAND IN INFRARED REFLECTION NEBULAE Abstract Only
Y. Pendleton, M. Werner, and A. G. G. M. Tielens *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 131-132 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Recent observations show that infrared reflection nebulae are common phenomena in star forming regions. Extensive observations were made of two nearby infrared reflection nebulae, Orin Molecular Cloud 2 IRS1 (OMC-2/IRS1) and Cepheus A IRS6a (Cep-A/IRS6a). Mie scattering models of ice coated grains were used to study the constraints on the properties and locations of grains that could produce a feature similar to that observed in OMC-2 and Cep-A. It was concluded that scattering by ice particles alone could not be responsible for the 3.1 micron feature observed in infrared reflection nebulae. B.G.

N87-15109*# Wisconsin Univ., Madison.
RELATIONSHIPS BETWEEN DUST GRAIN COMPONENTS RESPONSIBLE FOR OBSERVED INTERSTELLAR EXTINCTION AND POLARIZATION Abstract Only
Geoffrey C. Clayton *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 133-134 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Ultraviolet extinction properties of interstellar dust are well observed. The amount of extinction measured in the visible (E(B-V)), at the 2200 A feature (E(BUMP)), and in the far ultraviolet (E(1550-V)) are only vaguely correlated indicating that at least 3 fairly independent populations of grains contribute to the overall extinction curve. A search of literature was made for polarimetric observations of the 1415 stars included in the extinction catalog derived from the Astronomical Netherlands Satellite (ANS) data. It was found that about 900 of the stars had at least one unfiltered polarimetric observation, p (%). In addition, 150 stars had calculated values of lambda sub max (wavelength at which maximum polarization occurs). The lambda sub max and p/E(B-V) parameters are discussed. B.G.

N87-15110*# Princeton Univ. Observatory, N. J.
DEPLETIONS AND EXTINCTION CURVES FOR LINES OF SIGHT THROUGH THE OUTER EDGES OF TRULY DENSE MOLECULAR CLOUDS Abstract Only
Charles L. Joseph *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 135-136 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Observations of a few moderately reddened (0.3 is less than E(B-V) is less than 0.6) lines of sight through the outer edges of truly dense molecular clouds, not only show the overall depletions in these clouds to be as much as 0.5 (dex) greater than in comparably reddened diffuse clouds, but reveal a possible tendency for certain species to deplete preferentially. Possible methods of depletions are discussed. B.G.

N87-15111*# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE SHAPES OF THE CIRCUMSTELLAR SILICATE FEATURES Abstract Only
Irene R. Little-Marenin and Stephan D. Price *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 137-138 Prepared in cooperation with Wellesley Coll. (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Around oxygen-rich stars the spectra of most long-period variables (LPV) show an excess infrared emission which is attributed to circumstellar silicate dust grains. It is known that the spectral energy distribution of the 10 micron emissions shows variations from star to star. With the availability of many Infrared Astronomy Satellite (IRAS) Low Resolution Spectra (LRS) in the 8 to 22 micron region, the 10 micron feature can be studied to determine its uniformity (or lack thereof). The excess silicate emissions (10 micron emission), divided into three groups characterized by similar spectral shapes, are discussed. B.G.

N87-15112*# Colorado Univ., Boulder.
THE ULTRAVIOLET EXTINCTION IN M-SUPERGIANT CIRCUMSTELLAR ENVELOPES Abstract Only
Richard H. Buss, Jr. and Theodore P. Snow, Jr. *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 139-140 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Using International Ultraviolet (IUS) archival low-dispersion spectra, ultraviolet spectral extinctions were derived for the circumstellar envelopes of two M supergiants: HD 60414 and HD 213310. The observed stellar systems belong to a class of widely-separated spectroscopic binaries that are called VV Cephei stars. The total extinction was calculated by dividing the reddened fluxes with unreddened comparison fluxes of similar stars (g B2.5 for HD 213310 and a normalized s+B3 for HD 60414) from the reference atlas. After substracting the interstellar extinctions, which were estimated from the E(B-V) reddening of nearby stars, the resultant circumstellar extinctions were normalized at about 3.5 inverse microns. Not only is the 2175 A extinction bump absent in the circumstellar extinctions, but the far-ultraviolet extinction rise is also absent. The rather flat, ultraviolet extinction curves were interpreted as signatures of a population of noncarbonaceous, oxygen-rich grains with diameters larger than the longest observed wavelength. B.G.

N87-15113*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CHARACTERISTICS OF DUST IN CARBON RICH OBJECTS Abstract Only
R. F. Silverberg, H. Moseley, and W. Glaccum *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 141-142 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Some carbon-rich objects exhibit a strong broad emission feature beginning at lambda is approximately 24 microns and extending to lambda is greater than 30 microns. A 20 to 65 microm spectrum of the carbon star IRC+10216 and 30 to 50 micron spectra of three carbon-rich planetary nebulae, IC 418, NGC 6572, and BD+30 degrees 3639 are presented. The strong emission feature around 30 microns is seen clearly in IRC+10216, IC 418, and NGC 6572. The role of silicon carbides and magnesium sulfur particles in this feature is discussed. B.G.

N87-15114*# Leiden Univ. (Netherlands).
THE ORGANIC COMPONENT OF INTERSTELLAR GRAINS Abstract Only
W. A. Schutte and J. M. Greenberg *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 143-144 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The 3.4 micron absorption feature observed in the spectrum of a number of Galactic Center (GC) sources indicates the presence of organic molecules in the interstellar medium. It is ascribed to the C-H stretch vibration of tetrahedrally bonded carbon. From the observed features due to the interstellar organic material, an estimate was made of its composition and abundance. The ratio of the number of C-H groups of tetrahedrally to those of trigonally bonded carbon was 1.5, the cosmic abundance of carbon was

.00037, and the depth of the silicate absorption toward the GC was taken equal to 3.6. B.G.

N87-15115*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
MEASURING INTERSTELLAR GRAINS FROM THE HALOES OF BINARY X-RAY SOURCES Abstract Only
Y. Xu and R. McCray *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 145 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Coherent forward scattering of X-rays by interstellar grains creates a halo around the X-ray image of a compact source. The fractional halo brightness at 2 keV is typically of order 10% moderately reddened galactic sources. The angular brightness distribution of the halo, which extends over several arcminutes, indicates the size distribution of the grains, and the spectrum of the halo indicates the composition of the grains. The halo will persist for several hours after the point source vanishes during an eclipse of a binary source; this provides a way to avoid systematic errors in measuring halo brightness due to an extended point response function of the X-ray telescope. Indeed, it is possilbe to infer the size distribution and composition of the grains without an imaging X-ray telescope by observing the time-dependence of the halo spectrum during eclipse. Author

N87-15116*# Colorado Univ., Boulder. Center for Astrophysics and Space Astronomy.
MOLECULAR CATASTROPHES AND THE FORMATION OF CIRCUMSTELLAR DUST Abstract Only
Robert E. Stencel *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 147-148 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Interstellar dust grains are presumed in part to have their origins in the outer atmospheres of red giant and supergiant stars because, despite the efficiency of shock destruction of grains in the interstellar medium (ISM), meteoritic samples possess isotopic signatures that are consistent with nucleosynthetic origin in the interior of evolved stars. There is ample evidence to suggest that once dust grains form near red giants and supergiants, radiation pressure is sufficient to drive them to infinity. The molecular catastrophe description for the conversion of chromospheric gas into molecular masers and circumstellar dust holds promise for a coherent explanation of the formation of these entities and the process of mas loss from cool, high luminosity objects. B.G.

N87-15117*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
TRANSLUCENT MOLECULAR CLOUDS: THEORY AND OBSERVATIONS Abstract Only
Ewine F. vanDishoeck and John H. Black (Arizona Univ., Tucson) *In* NASA. Ames Research Center Summer School on Intestellar Processes: Abstracts of Contributed Papers Oct. 1986 p 149-150 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Few suitable stars behind molecular clouds have been identified. A limited survey was performed of interstellar lines toward highly reddened stars in the southern sky, using the ESO 1.4 m CAT telescope with a Reticon detector, and the Cerro Tololo 4 m telescope equipped with a GEC charge coupled device (CCD) detector. Because of the reduced extinction at longer wavelengths, molecules were searched for with transitions in the red part of the spectrum such as C2 and CN. For some lines-of-sight for which C2 was detected, the 4300 A line of CH was also observed. Absorption lines of interstellar C2 around 8750 A were detected in the spectra of about 1/4 of the 36 observed stars. The inferred C2 column densities range between 10 to the 13th power and 10 to the 14th power sq. cm., and are up to an order of magnitude larger than those found for diffuse clouds. The observed column densities of CH correlate very well with those of C2 over this range. In contrast, the measured column densities of CN vary by orders of magnitude between the various regions, and they do not correlate with those of C2 and CH. The observed rotational population distribution of C2 also provides information about the physical conditions in the clouds. Models of translucent molecular clouds have been constructed along the lines described by van Dishoeck and Black (1986) for diffuse clouds. The models compute accurately the fractions of atomic and molecular hydrogen as functions of depth into the clouds, as well as the excitation of H2 by ultraviolet pumping. They also incorporate a detailed treatment of the photodissociation processes of the molecules (cf. van Dishoeck 1986), which play an important role in the chemistry up to depths of about 3 mag. E.R.

N87-15118*# Duke Univ., Durham, N. C. Dept. of Physics.
DO LARGE RATE COEFFICIENTS FOR ION-POLAR NEUTRAL REACTIONS HAVE A SERIOUS EFFECT ON CHEMICAL MODELS OF DENSE CLOUDS? Abstract Only
Eric Herbst and Chun Ming Leung (Rensselaer Polytechnic Inst., Troy, N.Y.) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 151-152 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

In order to incorporate large ion-polar neutral rate coefficients into existing gas phase reaction networks, it is necessary to utilize simplified theoretical treatments because of the significant number of rate coefficients needed. The authors have used two simple theoretical treatments: the locked dipole approach of Moran and Hamill for linear polar neutrals and the trajectory scaling approach of Su and Chesnavich for nonlinear polar neutrals. The former approach is suitable for linear species because in the interstellar medium these are rotationally relaxed to a large extent and the incoming charged reactants can lock their dipoles into the lowest energy configuration. The latter approach is a better approximation for nonlinear neutral species, in which rotational relaxation is normally less severe and the incoming charged reactants are not as effective at locking the dipoles. The treatments are in reasonable agreement with more detailed long range theories and predict an inverse square root dependence on kinetic temperature for the rate coefficient. Compared with the locked dipole method, the trajectory scaling approach results in rate coefficients smaller by a factor of approximately 2.5. E.R.

N87-15119*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
STUDIES OF INTERSTELLAR VIBRATIONALLY-EXCITED MOLECULES Abstract Only
L. M. Ziurys, R. L. Snell, and N. R. Erickson *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 153-154 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Several molecules thus far have been detected in the ISM in vibrationally-excited states, including H2, SiO, HC3N, and CH3CN. In order for vibrational-excitation to occur, these species must be present in unusually hot and dense gas and/or where strong infrared radiation is present. In order to do a more thorough investigation of vibrational excitation in the interstellar medium (ISM), studies were done of several mm-wave transitions originating in excited vibrational modes of HCN, an abundant interstellar molecule. Vibrationally-excited HCN was recently detected toward Orion-KL and IRC+10216, using a 12 meter antenna. The J=3-2 rotational transitions were detected in the molecule's lowest vibrational state, the bending mode, which is split into two separate levels, due to l-type doubling. This bending mode lies 1025K above ground state, with an Einstein A coefficient of 3.6/s. The J=3-2 line mode of HCN, which lies 2050K above ground state, was also observed toward IRC+10216, and subsequently in Orion-KL. Further measurements of vibrationally-excited HCN were done using a 14 meter telescope, which include the observations of the (0,1,0) and (0,2,0) modes towards Orion-KL, via their J=3-2 transitions at 265-267 GHz. The spectrum of the J=3-2 line in Orion taken with the 14 meter telescope, is shown, along with a map, which indicates that emission from vibrationally-excited HCN

arises from a region probably smaller than the 14 meter telescope's 20 arcsec beam. E.R.

N87-15120*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
MULTI-LEVEL STUDY OF C3H2: THE FIRST INTERSTELLAR HYDROCARBON RING Abstract Only
S. C. Madden, W. M. Irvine, H. E. Matthews (Herzberg Inst. of Astronomy, Ottawa, Ontario), and L. W. Avery *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 155-156 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Cyclic species in the interstellar medium have been searched for almost since the first detection of interstellar polyatomic molecules. Eleven different C3H2 rotational transitions were detected; 9 of which were studied in TMC-1, a nearby dark dust cloud, are shown. The 1 sub 10 yields 1 sub 01 and 2 sub 20 yields 2 sub 11 transitions were observed with the 43 m NRAO telescope, while the remaining transitions were detected with the 14 m antenna of the Five College Radio Observatory (FCRAO). The lines detected in TMC-1 have energies above the ground state ranging from 0.9 to 17.1 K and consist of both ortho and para species. Limited maps were made along the ridge for several of the transitions. The HC3N J = 2 yields 1 transition were mapped simultaneously with the C3H2 1 sub 10 yields 1 sub 01 line and therefore can compare the distribution of this ring with a carbon chain in TMC-1. C3H2 is distributed along a narrow ridge with a SE - NW extension which is slightly more extended than the HC2N J = 2 yields 1. Gaussian fits gives a FWHP extension of 8'5 for C3H2 while HC3N has a FWHP of 7'. The data show variations of the two velocity components along the ridge as a function of transition. Most of the transitions show a peak at the position of strongest HC3N emission while the 2 sub 21 yields 2 sub 10 transition shows a peak at the NH3 position. E.R.

N87-15121*# California Univ., Berkeley.
EFFECTS OF STELLAR OUTFLOWS ON INTERSTELLAR SULFUR OXIDE CHEMISTRY Abstract Only
W. J. Welch, S. Vogel (California Inst. of Tech., Pasadena), S. Terebey, J. Dreher (Massachusetts Inst. of Tech., Cambridge), J. Jackson, and J. Carlstrom *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 157-158 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Interferometer Maps with 2' to 6' resolution of a number of regions with active star formation (Orion A, W49, W51, SGRB2) show that the distribution of the molecule SO is very compact around stellar outflow sources. Both SO and SO2 were studied near three outflows, OrionA/IRc2 and two sources in W49. The two molecules have similar distributions and abundances. More than 95% of the emission comes from regions whose extents are only .05 to .2 pc., being larger around the more energetic sources. Their spectra are broad, 30 km/sec or more, suggesting that the oxide production is associated with the flows. The outflows are identified by water masers and by extended bipolar flows in SiO. Maps in other molecules, such as HCO+ and CS, which have similar collisional excitation requirements, have much greater spatial extent. Thus it appears that the SO and SO2 abundances are truly compact and are closely associated with the outflows.
Author

N87-15122*# Colorado Univ., Boulder. Center for Astrophysics and Space Astronomy.
INTERSTELLAR ABSORPTION LINES IN THE SPECTRUM OF SIGMA SCO USING COPERNICUS OBSERVATIONS Abstract Only
M. Marsha Allen and Theodore P. Snow *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 159-160 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Since the launch of Copernicus in 1972, studies have been made of the depletion of gas-phase elements onto dust grains. A few stars have been studied in detail, resulting in a standard depletion pattern which has since been used for comparison. Recent developments, however, have suggested that this standard pattern may need to be re-examined. Some weak, semi-forbidden lines were detected recently which may be able to resolve some of the ambiguities. Studies of single elements have shown that depletion of carbon and oxgyen are much smaller than previously determined. The high resolution ultraviolet spectral scans of sigma Sco were originally made in 1973, but have only recently been analyzed. All these stars are bright and moderately reddened. All four stars will be analyzed in detail, but sigma Sco is the first one completed. The data has broad coverage of ions, making these stars excellent candidates for determination of accurate depletions. A profile-fitting analysis was used rather than curves-of-growth in order to determine separate abundances and depletions in components separated by several km/sec. E.R.

N87-15123*# Rutherford High Energy Lab., Chilton (England).
THE ABUNDANCE OF INTERSTELLAR SULPHUR AND ZINC IN HIGH DENSITY SIGHT-LINES Abstract Only
A. W. Harris and J. M. MasHesse (Universidad Complutense, Madrid, Spain) *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 161-162 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

On the basis of early absorption line studies of individual lines of sight with the Copernicus satellite, chlorine, sulphur and zinc were classed together as elements which showed little or no depletion, relative to hydrogen, in the interstellar medium. The abundances of other less volatile elements, such as Fe and Mg were found to vary widely from one sight-line to another with gas-phase abundances in some cases being orders of magnitude below their solar counterparts. Detailed studies are reported of the depletion/density behavior of two other volatile elements which were previously considered to be virtually undepleted, S and Zn, using equivalent width data from both Copernicus and IUE observations. The results provide further evidence that the established dependence of depletion on n bar (H) extends to volatile elements and show that their use as tracers of metallicity, or for estimating hydrogen column densities, may lead to large errors in sight-lines through dense regions. It now appears that such elements may take part in the surface chemistry of grains and be important constituents of grain mantle material, although they probably do not contribute significantly to the bulk mass of grains. Due to the very similar atomic masses and ionization potentials of sulphur and phosphorous, the thermal velocity distributions of the singly ionized species of these elements in interstellar clouds should be very similar. However, a comparison of Doppler widths (b-values) derived for SIT and PIT in the same sight-lines from the Bohlin et al Copernicus equivalent width measurements has revealed an unexpected systematic discrepancy of a factor of approx. 1.7. This Discrepancy indicates that the normally adopted oscillators strengths of the PII lambda lambda 1153 and 1302 A lines may require revision. E.R.

N87-15124*# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
IUE/IRAS STUDIES OF METAL ABUNDANCES AND INFRARED CIRRUS Abstract Only
Michael E. VanSteenberg and J. Michael Shull *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 163-164 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

A survey is reported of interstellar densities, abundances, and cloud structure in the Galaxy, using the IUE and IRAS satellites. Heavy element depletions are discussed along with their correlations with mean density, reddening, and galactic location. Interesting correlations between the Fe/Si abundance ratio and the infrared diffuse cirrus is also reported, which may provide information on the history and formation of grains in the galactic halo.
Author

N87-15125*# Observatoire de Paris-Meudon (France).
FRAGMENTED MOLECULAR COMPLEXES: THE ROLE OF THE MAGNETIC FIELD IN FEEDING INTERNAL SUPERSONIC MOTIONS Abstract Only
E. Falgarone, J. L. Puget, and M. Perault *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 165 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

A hierarchical structure for molecular complexes in their cold phase i.e., preceeding the formation of massive stars, was derived from extensive large scale CO(13)(J=1=0) observations: the mass is found to be distributed into virialized clouds which fill only a very low fraction approx. 01 of the volume of the complex and are supported against gravity by internal supersonic motions. An efficient mechanism was found to transfer kinetic energy from the orbital motions of the clouds to their internal random motions. The large perturbations of the magnetic field induced at the cloud boundaries by their interactions with their neighbors generate systems of hydromagnetic waves trapped inside the clouds. The magnetic field lines being closely coupled to the gas at the densities which prevail in the bulk of the clouds volume, internal velocity dispersion is thus generated. Some conclusions derived from this data are given. Author

N87-15126*# Chicago Univ., Ill. Dept. of Astronomy and Astrophysics.
ON THE INTERPRETATION OF THE BETA(SUB p) RELATION IN INTERSTELLAR CLOUDS Abstract Only
Arieh Koenigl *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 166-168 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Troland and Heiles (1986) have recently presented an updated compilation of observational data concerning the relationship between the interstellar magnetic field strength B and the gas density rho (or, equivalently, the particle density n). One of the main findings of their survey was that B remains constant over the density range 0.1 - approx. 100 cu. cm and shows evidence for increase only a higher densities. They compared this result with theoretical predictions based on the Parker-instability scenario for the formation and evolution of interstellar clouds in the presence of the galactic magnetic field. In this picture, low-density gas is driven by the magnetic Rayleigh-Taylor instability into magnetic valleys, where it accumulates into denser concentrations. The gas initially flows along the magnetic field lines and there is little increase of the field strength with density; B only starts to rise when n becomes large enough for self-gravity to begin competing with the magnetic stresses. For a cloud mass of approx. 1,000 sub M and the measured background field strength, the critical density for contraction in approx. 75 cu. cm. Troland and Heiles therefore concluded that this scenario is basically consistent with the observations. This conclusion is debated. Author

N87-15127*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
MAGNETIC FIELD IN MOLECULAR CLOUD CORES: LIMITS ON FIELD STRENGTHS AND LINEWIDTHS Abstract Only
Alyssa A. Goodman *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 169-170 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Preliminary observations by others indicate that the magnetic field strength in dense molecular cloud cores is on the order of 30 micro G, much closer to the background field strength than to the flux-freezing prediction for this density. This result implies that some process must exist to decrease the magnetic field strength in these regions to much less than its flux-frozen value, e.g., ambipolar diffusion. At these moderate field strengths, magnetohydrodynamic waves in the cores provide a good explanation of observed supra-thermal molecular linewidths. Author

N87-15128*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODELS FOR APPLICATION OF RADIATION BOUNDARY CONDITION FOR MHD WAVES IN COLLAPSE CALCULATIONS Abstract Only
C. T. Vanajakshi, E. H. Scott (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.), and David C. Black (National Aeronautics and Space Administration, Washington, D.C.) *In its* Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 171-172 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

The problem of reflection of magnetohydrodynamic (MHD) waves at the boundary of a numerical grid has to be resolved in order to obtain reliable results for the end state of the (isothermal) collapse of a rotating, magnetic protostellar cloud. Since the goal of investigating magnetic braking in collapse simulations is to see if the transport of angular momentum via alfven waves is large enough to solve the angular momentum problem an approximation that artificially suppresses large amplitudes in the MHD waves can be self-defeating. For this reason, four alternate methods of handling reflected waves where no assumptions are made regarding the amplitudes of the waves were investigated. In order to study this problem (of reflection) without interference from other effects these methods were tried on two simpler cases. The four methods are discussed. E.R.

N87-15129*# Chicago Univ., Ill. Dept. of Astronomy and Astrophysics.
MAGNETIC BRAKING IN WEAKLY IONIZED CIRCUMSTELLAR DISKS Abstract Only
Arieh Koenigl *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 173-174 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

Recent observations of disk-like mass distributions around newly formed stars have provided evidence for rapid rotation on scales similar to less than 0.1pc with specific angular momenta much higher than typical stellar values. A likely mechanism for the extraction of angular momentum from these regions is magnetic braking by means of Alfven waves that propagate into the lower-density ambient medium. However, because of the relatively high particle densities and the correspondingly low implied ionization fractions in these apparent disks, their constituent ions and neutrals need not be well coupled to each other and could develop large relative drift velocities. For this reason, previous treatments of magnetic braking that assumed perfect coupling between ions and neutrals have to be modified in this case. In particular, one has to take into account both the azimuthal drift that develops because only the ions are directly coupled to the magnetic field and the radial drift (or ambipolar diffusion) which leads to a redistribution (and leakage) of the magnetic flux. The results of a preliminary analysis of these effects are described.
Author

N87-15130*# Arizona State Univ., Tempe.
COMET P/HALLEY 1910, 1986: AN OBJECTIVE-PRISM STUDY Abstract Only
U. Carsenty, E. S. Bus (Lowell Observatory, Flagstaff, Ariz.), S. Wyckoff, and B. Lutz *In* NASA. Ames Research Center Summer School on Interstellar Processes: Abstracts of Contributed Papers Oct. 1986 p 175-176 (For primary document see N87-15043 06-90)
Avail: NTIS HC A10/MF A01 CSCL 03B

V. M. Slipher of the Lowell Obs. collected a large amount of spectroscopic data during the 1910 apparition of Halley's comet. Three of his post perihelion objective-prism plates were selected, digitized, and subjected to modern digital data reduction procedures. Some of the important steps in the analysis where: (1) Density to intensity conversion for which was used 1910 slit spectra of Fe-arc lamp on similar plates (Sigma) and derived an average characteristic curve; (2) Flux calibration using the fact that during the period June 2 to 7 1910 P/Halley was very close (angular

distance) to the bright star Alpha Sex (A0III, V-4.49), and the spectra of both star and comet were recorded on the same plates. The flux distribution of Alpha Sex was assumed to be similar to that of the standard star 58 Aql and derived a sensitivity curve for the system; (3) Atmospheric extinction using the standard curve for the Lowell Obs.; (4) Solar continuum subtraction using the standard solar spectrum binned to the spectral resolution. An example of a flux-calibrated spectrum of the coma (integrated over 87,000km) before the subtraction of solar continuum is presented. E.R.

N87-15131*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVOLUTION AND INTERACTION OF LARGE INTERPLANETARY STREAMS

Y. C. Whang (Catholic Univ. of America, Washington, D.C.) and L. F. Burlaga Feb. 1985 41 p

(NASA-TM-86192; NAS 1.15:86192) Avail: NTIS HC A03/MF A01 CSCL 54C

A computer simulation for the evolution and interaction of large interplanetary streams based on multi-spacecraft observations and an unsteady, one-dimensional MHD model is presented. Two events, each observed by two or more spacecraft separated by a distance of the order of 10 AU, were studied. The first simulation is based on the plasma and magnetic field observations made by two radially-aligned spacecraft. The second simulation is based on an event observed first by Helios-1 in May 1980 near 0.6 AU and later by Voyager-1 in June 1980 at 8.1 AU. These examples show that the dynamical evolution of large-scale solar wind structures is dominated by the shock process, including the formation, collision, and merging of shocks. The interaction of shocks with stream structures also causes a drastic decrease in the amplitude of the solar wind speed variation with increasing heliocentric distance, and as a result of interactions there is a large variation of shock-strengths and shock-speeds. The simulation results shed light on the interpretation for the interaction and evolution of large interplanetary streams. Observations were made along a few limited trajectories, but simulation results can supplement these by providing the detailed evolution process for large-scale solar wind structures in the vast region not directly observed. The use of a quantitative nonlinear simulation model including shock merging process is crucial in the interpretation of data obtained in the outer heliosphere. Author

N87-15132# International Centre for Theoretical Physics, Trieste (Italy).

POSSIBLE EVOLUTION SCHEME FOR THE UNIVERSE IN CONFORMAL GRAVITY

K. G. Akdeniz, J. Kalayci, and A. Hacinliyan Aug. 1985 7 p Prepared in cooperation with Bogazici Univ., Istanbul, Turkey

(DE86-702715; IC-85/151) Avail: NTIS (US Sales Only) HC A02/MF A01

A possible evolution scheme for the universe by spontaneous changes in the cosmological constant is analyzed. DOE

N87-15133# International Centre for Theoretical Physics, Trieste (Italy).

COSMIC SUPERSTRINGS AND RELATED TOPICS

Q. Shafi Jul. 1985 8 p

(DE86-702738; IC-85/86) Avail: NTIS (US Sales Only) HC A02/MF A01

Some consequences of merging together superstring theories and cosmology are discussed. Witten's description of a heterotic superstring as a superconducting axion vortex (or string) connected to a single axion domain wall is addressed. M.G.

N87-15134# International Centre for Theoretical Physics, Trieste (Italy).

SUPERUNIFICATION, PHASE TRANSITIONS AND COSMOLOGY

C. E. Vayonakis Oct. 1985 111 p

(DE86-702955; IC-85/231) Avail: NTIS (US Sales Only) HC A06/MF A01

We survey the main features behind the idea of grand unification, both without and with (local) supersymmetry. We then study the high-temperature phase transitions in the theories so realized, and their relevance to the cosmology of the early universe. In particular, we review the basic ingredients of (super) grand unified models and we give the basic tools needed for the study of their phase transitions. After a short introduction to cosmology, we focus on the interplay between unified particle physics models and cosmology, with particular emphasis on the inflationary universe scenario. In the same perspective, new research directions, in the context of higher-dimensional theories, are also discussed. DOE

N87-15135# Brookhaven National Lab., Upton, N. Y. Physics Dept.

NEUTRON STAR FORMATION IN THEORETICAL SUPERNOVAE. LOW MASS STARS AND WHITE DWARFS

K. Nomoto 1986 24 p Presented at the Conference on the Origin and Evolution of Neutron Stars, Nanjing, China, 26 May 1986

(Contract DE-AC02-76CH-00016)

(DE86-016168; BNL-38555; CONF-8605190-1) Avail: NTIS HC A02/MF A01

The presupernova evolution of stars that form semi-degenerate or strongly degenerate O + Ne + Mg cores is discussed. For the 10 to 13 Msub solar stars, behavior of off-center neon flashes is crucial. The 8 to 10 m/sub solar stars do not ignite neon and eventually collapse due to electron captures. Properties of supernova explosions and neutron stars expected from these low mass progenitors are compared with the Crab nebula. The conditions for which neutron stars form from accretion-induced collapse of white dwarfs in clsoe binary systems is also examined. DOE

N87-15136*# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

DOUBLE LAYERS AND CIRCUITS IN ASTROPHYSICS

Hannes Alfven May 1986 61 p Presented at Double Layers in Astrophysics Symposium, Huntsville, Ala., 17-19 Mar. 1986 Sponsored by NASA, NSF, and Naturvetenskapliga Forskningsraadet

(NASA-CR-180018; NAS 1.26:180018; TRITA-EPP-86-04; ISSN-0348-7539; ETN-86-98325) Avail: NTIS HC A04/MF A01 CSCL 03B

A simple circuit is applied to the energizing of auroral particles, to solar flares, and to intergalactic double radio sources. Application to the heliospheric current systems leads to the prediction of two double layers on the Sun's axis which may give radiations detectable from Earth. Double layers in space should be classified as a new type of celestial object. It is suggested that X-ray and gamma-ray bursts may be due to exploding double layers (although annihilation is an alternative energy source). The way the most used textbooks in astrophysics treat concepts like double layers, critical velocity, pinch effects and circuits was studied. It is found that students using these textbooks remain essentially ignorant of even the existence of these, although some of the phenomena were discovered 50 yr ago. ESA

N87-15137# University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.

ORGANIC GRAINS IN COMETS

Fred Hoyle and N. C. Wickramasinghe 17 Mar. 1986 93 p

(Preprint-122; ETN-86-98362) Avail: NTIS HC A05/MF A01

Formaldehyde polymers in comets; comets, ice ages, and ecological catastrophes; interstellar grains; comets as a vehicle for panspermia; infrared spectroscopy over the 2.9 to 3.9 micron waveband in biochemistry and astronomy; organo-siliceous biomolecules and the infrared spectrum of Trapezium nebula; dust grains in the comas of comets Cernis and Bowell; Halley's comet; and the biochemistry of the origins of life on Earth are discussed. ESA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N87-15138*# National Aeronautics and Space Administration, Washington, D.C.
PLANETARY EXPLORATION THROUGH YEAR 2000, A CORE PROGRAM: MISSION OPERATIONS
1986 58 p
(NASA-TM-89275; NAS 1.15:89275) Avail: NTIS HC A04/MF A01 CSCL 03B

In 1980 the NASA Advisory Council created the Solar System Exploratory Committee (SSEC) to formulate a long-range program of planetary missions that was consistent with likely fiscal constraints on total program cost. The SSEC had as its primary goal the establishment of a scientifically valid, affordable program that would preserve the nation's leading role in solar system exploration, capitalize on two decades of investment, and be consistent with the coordinated set of scientific stategies developed earlier by the Committe on Planetary and Lunar Exploration (COMPLEX). The result of the SSEC effort was the design of a Core Program of planetary missions to be launched by the year 2000, together with a realistic and responsible funding plan. The Core Program Missions, subcommittee activities, science issues, transition period assumptions, and recommendations are discussed. B.G.

N87-15139*# National Aeronautics and Space Administration, Washington, D.C.
GEOLOGICAL-MORPHOLOGICAL DESCRIPTION OF THE SEDNA AND GUINEVRE PLANITIAE ON VENUS (PHOTOMAP SHEETS B-11, B-20, B-21)
A. A. Pronin, G. A. Burba, N. N. Bobina, Yu. S. Tyuflin, A. I. Sidorenko, S. A. Kadnichanskiy, M. V. Ostrovskiy, V. A. Kotelnikov, O. N. Rzhiga, G. M. Petrov et al Sep. 1986 15 p Transl. into ENGLISH from "Geologo-Morfologicheskoye Opisaniye Ravnin Sedny i Ginevry na Venerye (Listy Fotokarty B-11, B-20, B-21)" IN: Astronomicheskiy Vestnik (Moscow, USSR), Nauka, v. 20, no. 3, 1986 p 163-176 Transl. by Scitran, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88494; NAS 1.15:88494) Avail: NTIS HC A02/MF A01 CSCL 84B

Presented are descriptions and maps of the region of Sedna and Guinevra Planitiae--representatives of the largest geological providense on Venus comprised of volcanic rock. Units of different age are isolated and their relations are given, as well as interpretations of proposed mechanisms of formation. Author

N87-15140*# National Aeronautics and Space Administration, Washington, D.C.
GEOMETRIC PRINCIPLES FOR CONSTRUCTING RADAR PANORAMAS OF THE SURFACE OF VENUS: HYPSOMETRIC FEATURES OF THE MOON AND TERRESTRIAL PLANETS
O. N. Rzhiga, Yu. S. Tyuflin, Ye. G. Belenkiy, Zh. F. Rodionova, and K. I. Dekhtyareva Dec. 1986 4 p Transl. into ENGLISH from "Geometricheskiye Printsipy Postroyeniya Radiolokatsionnykh Panoram Poverkhnosti Venery" IN: Geodeziya i Kartografiya (Moscow, USSR), no. 9, 1985 p 48; and "Gipsometricheskiye Osobennosti Luny i Planet Zemnoy Grupy" IN: Problemy Kompleksnogo Issledovaniya Luny (Moscow, USSR), 1986 p 56-57 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88532; NAS 1.15:88532) Avail: NTIS HC A02/MF A01 CSCL 84B

The physographic curves of the moon and terrestrial planets, drawn both for the entire surface as a whole and for individual hemispheres, were compared to discover the common consistencies and individual features in the distribution of hypsometric levels. In 1983 to 1984 the automated interplanetary stations (AMS) Venera 15 and 16 made radar maps of the planet Venus. The synthesized images are the basic initial material for photogrammetric and catrographic processing to create maps of the Venus surface. These principles are discussed. B.G.

N87-15141*# National Aeronautics and Space Administration, Washington, D.C.
STRUCTURAL ENSEMBLES OF THE NORTH BELT OF VENUS DEFORMATIONS AND POSSIBLE MECHANISMS OF THEIR FORMATION
M. S. Markov Oct. 1986 21 p Transl. into ENGLISH from "Strukturnyye Ansambli Severnogo Poyasa Deformatsiy na Vednerye i Vosmozhnyye Mekhanizmy ikh Obrazovaniya" IN: Geotektonika (Moscow, USSR), Nauka, no. 4, Jul. - Aug. 1986 p 77-87 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88511; NAS 1.15:88511; ISSN-0016-853X) Avail: NTIS HC A02/MF A01 CSCL 84B

The author discusses structural formations in the northern deformation belt of Venus, studied according to the data of the radar pictures obtained with the Venera 15 and 16 probes. He shows that it consists of regions of compression with submeridional orientation, regions of displacement, extending in the sublatitudinal direction and individual slightly deformed blocks. He puts forward the hypothesis that the formation of these structures is related with horizontal movements in the mantle in the sublatitudinal direction. Author

N87-15142*# National Aeronautics and Space Administration, Washington, D.C.
PHOBOS AND DEIMOS: SATELLITES OF MARS
V. M. Zharkov and A. V. Kozenko Oct. 1986 52 p Transl. into ENGLISH of "Fobos i Deimos: Sputniki Marsa" IN: Novoye v Zhizni, Nauke, Tekhnike, Seriya: Kosmonavitika, Astronomiya (Moscow, USSR), Znaniye, no. 1, 1985 p 1-64 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88016; NAS 1.15:88016) Avail: NTIS HC A04/MF A01 CSCL 84B

The physical characteristics of Phobos and Deimos, satellites of Mars, are discussed. Phobos and Deimos are used as an example to discuss the probable internal structure of objects of this type and the structural formations on their surfaces. The history of astronomical observations of Mars is also described. B.G.

N87-15143*# National Aeronautics and Space Administration, Washington, D.C.
GEOLOGICAL-MORPHOLOGICAL DESCRIPTION OF THE ISHTAR TERRA (PHOTOMAP OF THE VENUSIAN SURFACE SHEET B-5)
A. L. Sukhanov, A. A. Pronin, Yu. S. Tyuflin, M. V. Ostrovskiy, V. A. Kotelnikov, O. N. Rzhiga, G. I. Petrov, A. I. Sidorenko, Yu. N. Aleksandrov, A. I. Zakharov et al Sep. 1986 15 p Transl. into ENGLISH from "Geologo-Morfologicheskoye Opisaniye Zemli Istar (Fotokarta Poverkhnosti Venery, List B-5)" Astronomicheskiy Vestnik, Moscow, USSR, Nauka, v. 20, no. 2, 1986 p 99-111 Transl. by Scitran, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88497; NAS 1.15:88497) Avail: NTIS HC A02/MF A01 CSCL 84B

The main part of the Ishtar Terra east of the Maxwell Montes is covered with systems of areal dislocations of several directions, which are called Parquet. According to the structural patterns these may be divided into: (1) the central stable block; (2) the lesser peripheral blocks separated from the central one by gaps and grabens; (3) the zones of mobilized parquet, whose substance flowed downward at an incline in the directions away from the central block in the form of plastic flows; and (4) the partially parqueted lava sheets. The Maxwell Montes were formed as a result of the collision between the central parquet block and the Lakshmi Planum. Author

N87-15144*# National Aeronautics and Space Administration, Washington, D.C.
THE LAKSHMI PLATEAU STRUCTURE AS AN INDICATOR OF ASTHENOSPHERE HORIZONTAL FLOWS ON VENUS
A. A. Pronin Oct. 1986 28 p Transl. into ENGLISH from "Stroyeniye Plato Lakshmi Kak Svidetelstvo Gorizontalnykh Astenosfernykh Potokov na Venere" IN: Geotektonika (USSR), no. 4, Jul. - Aug. 1986 p 26-41 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88507; NAS 1.15:88507) Avail: NTIS HC A03/MF A01 CSCL 84B

The structure of Lakshmi Planum in the western part of Ishtar Terra in a fold-fault setting which conforms to the basic massif of the plateau with eruptive centers is constructed concentrically and is interpreted from the point of view of the subsurface flow of materials in the form of horizontally diverging asthenospheric flows and gravitational creep. The surrounding structures are formed by the deformation of the more rigid lithosphere as it breaks away from the asthenospheric flow. Author

N87-15145*# National Aeronautics and Space Administration, Washington, D.C.
THE STRUCTURE OF THE ISHTAR TERRA CENTRAL AND EASTERN PARTS AND SOME TECTONIC PROBLEMS OF VENUS
A. T. Bazilevskiy Oct. 1986 20 p Transl. into ENGLISH from "Stroyeniye Tsentralnoy i Vostochnoy Chastey Zemli Ishtar i Nekotoryye Problemy Tektoniki Venery" (USSR), Geotektonika, no. 4, Jul.-Aug 1986 p 42-53 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by GEOKhI of the USSR Academy of Sciences
(Contract NASw-4005)
(NASA-TM-88508; NAS 1.15:88508) Avail: NTIS HC A02/MF A01 CSCL 84B

Moving from the Maxwell Montes to the eastern edge of Ishtar Terra there is a gradual shift in submeridional meandering folded ranges in the western section of the area to straight intersecting disjunctive systems of connected faults and sublatitudinal shifts. These disjunctive systems evidently transform older structures; the major axis of the stresses created by them is primarily oriented sublatitudinally. Relative to younger structures, in the western they occupy a higher hypsometric position. The reason for the formation of this entire system may be a large astenospheric flow wihch rise in the region of Lakashmi Planum and Maxwell Montes and which spreads and plunges in an easterly direction, taking with it deformed blocks of the lithosphere. Author

N87-15146*# National Aeronautics and Space Administration, Washington, D.C.
STRESS ON THE SURFACE OF VENUS: ANALYSIS OF DATA PROVIDED BY VENERA-15 AND VENERA-16
L. B. Ronka Oct. 1986 11 p Transl. into ENGLISH from "O Napryazheniyakh na Poverkhnosti Venery: Isucheniye Dennykh Venery-15 i Venery-16" IN: Geotektonika (Moscow, USSR), Nauka, no. 4, Jul. - Aug. 1986 p 54-59 Transl. By Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88509; NAS 1.15:88509; ISSN-0016-853X) Avail: NTIS HC A02/MF A01 CSCL 84B

There are no large-scale sedimentation and erosion processes on Venus, therefore the observed deformation must be formed on the surface or close to it, and in the ellipsoids of stresses one of the main axes must be perpendicular to the surface. According to the deformation visible on photography from Venera-15, 16, the orientations of the ellipsoids of stresses are established in the different sections of the Montes Maxwell and the northern parquet. A geological model is established, according to which the Montes Maxwell is an arched vault and the region to the south a conjugate bend, separated by a shift zone. Author

N87-15147*# National Aeronautics and Space Administration, Washington, D.C.
PARQUET: REGIONS OF AREAL PLASTIC DISLOCATIONS (ON VENUS)
A. L. Sukhanov Oct. 1986 28 p Transl. into ENGLISH from "Parket: Oblasti Plozhchadnykh Plasticheskikh Dislokatsiy" IN: Geotektonika (Moscow, USSR), Nauka, no. 4, Jul. - Aug. 1986 p 60-76 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88510; NAS 1.15:88510; ISSN-0016-853X) Avail: NTIS HC A03/MF A01 CSCL 84B

The extensive flat elevations of the Northern Hemisphere of Venus are covered with frequently intersecting lines of dislocations, resembling the outline of a giant parquet. In the internal sections of these regions we find grabens and regions of extension, and on the periphery lobe-shaped flow structures. The parquet was formed after the beginning of the formation of the lava plains, but covered by the youngest lava. These structures apparently arose partly because of the dragging of blocks of crust by the asthenospheric flows, and partly in the gravitational sliding of such heated blocks in the partial melting of their base. It is possible that these elevations occupy on Venus the place of the Earth's rift systems. Author

N87-15148*# National Aeronautics and Space Administration, Washington, D.C.
THE PLANETS OF THE SOLAR SYSTEM
M. Ya. Marov Nov. 1986 211 p Transl. into ENGLISH of book "Planety Solnechnoy Sistem" Moscow, USSR, Nauka p 1-320 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-88015; NAS 1.15:88015) Avail: NTIS HC A10/MF A01 CSCL 84B

This book is intended both for the lay person and the would-be scientist. The planets are discussed with a comparision of their basic natural features: mechanical characteristics and parameters of movement, surfaces, inner structure, physical properties of the atmosphere and meteorology. Also general problems of planetary cosmogony, thermal history and climatic evolution are considered briefly. The book is based on Soviet and foreign material, data from spacecraft, Earth optical and radio astronomical measurements and also data obtained from theoretical models. Author

N87-15149*# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
STUDIES OF RADIATIVE TRANSFER IN PLANETARY ATMOSPHERES Semiannual Status Report, 1 Jun. - 30 Nov. 1986
William M. Irvine and F. Peter Schloerb 1986 10 p
(Grant NGL-22-010-023)
(NASA-CR-180021; NAS 1.26:180021; SASR-39) Avail: NTIS HC A02/MF A01 CSCL 84B

Schloerb and Claussen continued their analysis of the very high quality data set obtained on the 18 centimeter OH line from the Comet P/Halley with the NRAO 43 meter antenna. The high spectral resolution (0.22 km/sec) and high signal-to-noise of the OH spectra make them ideal for the study of kinematics in the coma. Synthetic profiles were initiated for comparison with the data. A vectorial model was developed using the Monte Carlo techniques originated by Combi and Delsemme. Analysis of the millimeter wavelength observations of HCN emission from P/Halley obtained throughout much of the recent apparition were continued using the University of Massachusetts 14 millimeter-wavelength (FCRAO) antenna. A detailed analysis of the HCN lineshpaes was performed over the last six months. The excitation of HCN in the coma was studied to obtain a detailed match to the observed spectra. The passive millimeter wave radiometer was used to probe the physical and chemical nature of comets from spacecraft. Work was continued on an improved theory of radiative transfer for rough and porous surfaces, such as the regoliths of satellites, asteroids, and comets. B.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N87-15150*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EPHEMERAL ACTIVE REGIONS AND CORONAL BRIGHT POINTS: A SOLAR MAXIMUM MISSION 2 GUEST INVESTIGATOR STUDY Final Report

Karen L. Harvey (Solar Physics Research Corp., Tucson, Ariz.), Frances Y. C. Tang (California Inst. of Tech., Pasadena), Victor Gaizauskas (National Research Council of Canada, Ottawa, Ontario), and Arthur I. Poland 17 May 1986 46 p

(Contract NAS5-28728)

(NASA-CR-177900; NAS 1.26:177900) Avail: NTIS HC A03/MF A01 CSCL 54C

A dominate association of coronal bright points (as seen in He wavelength 10830) was confirmed with the approach and subsequent disappearance of opposite polarity magnetic network. While coronal bright points do occur with ephemeral regions, this association is a factor of 2 to 4 less than with sites of disappearing magnetic flux. The intensity variations seen in He I wavelength 10830 are intermittent and often rapid, varying over the 3 minute time resolution of the data; their bright point counterparts in the C IV wavelength 1548 and 20 cm wavelength show similar, though not always coincident time variations. Ejecta are associated with about 1/3 of the dark points and are evident in the C IV and H alpha data. These results support the idea that the anti-correlation of X-ray bright points with the solar cycle can be explained by the correlation of these coronal emission structures with sites of cancelling flux, indicating that, in some cases, the process of magnetic flux removal results in the release of energy. That the intensity variations are rapid and variable suggests that this process works intermittently. B.G.

N87-15151*# Stanford Univ., Calif. Center for Space Science and Astrophysics.

AN ATLAS OF PHOTOSPHERIC MAGNETIC FIELD OBSERVATIONS AND COMPUTED CORONAL MAGNETIC FIELDS: 1976 - 1985

J. Todd Hoeksema and Philip H. Scherrer 1986 13 p Previously announced in IAA as A87-12132

(Contract NAS5-24420; Grant NGR05-020-559; Contracts N00014-76-C-0207; N0014-86-K-0085; Grants NSF ATM-74-19007; NSF ATM-77-20580; NSF ATM-80-20421; NSF ATM-83-13271)

(NASA-CR-180019; NAS 1.26:180019; CSSA-ASTRO-86-28; AD-A168046) Avail: NTIS HC A02/MF A01 CSCL 54C

Daily magnetogram observations of the large-scale photospheric magnetic field have been made at the John M. Wilcox Solar Observatory at Stanford since May of 1976. These measurements provide a homogeneous record of the changing solar field through most of solar cycle 21. Using the photospheric data, the configuration of the coronal and heliospheric fields can be calculated using a Potential Field-Source Surface model. This provides a three-dimensional picture of the heliospheric field evolution during the solar cycle. This paper announces the publication of UAG Report No. 94, an Atlas containing the complete set of synoptic charts of the measured photospheric magnetic field, the computed field at the source surface, and the coefficients of the multipole expansion of the coronal field. The general underlying structures of the solar and heliospheric fields, which determine the environment for solar-terrestrial relations and provide the context within which solar activity related events occur, can be approximated from these data. Author

N87-15152# Naval Research Lab., Washington, D. C.

A SEARCH FOR PRECURSOR ACTIVITY ASSOCIATED WITH CORONAL MASS EJECTIONS, USING WHITE-LIGHT CORONAGRAPH OBSERVATIONS OBTAINED WITH THE SOLWIND INSTRUMENT ON BOARD THE AIR FORCE P78-1 SATELLITE Final Report, 15 Sep. 1984 - 31 Dec. 1985

Judith T. Karpen 31 Dec. 1985 26 p

(Contracts MIPR-FY71-218500006; AF Proj. 2311)

(AD-A170139; AFGL-TR-86-0056) Avail: NTIS HC A03/MF A01 CSCL 03/2

Large-scale coronal disturbances preceding solar flares or other surface activity and resulting in mass ejection, are perhaps the most intriguing and least understood manifestations of preflare/pre mass ejection activity. The existence of energetic disturbances in the corona significantly before the associated surface events has profound implications for the location and mechanism of preflare energy storage, as well as the evolution and magnitude of the energy release or magnetic disequilibrium characterizing the interval before and during the mass ejection. A systematic search for forerunners is performed using the white light coronagraph observations obtained with the WOLWIND instrument on board the P78-1 satellite. 44 bright, well observed events are selected and analyzed. In comparing the SOLWIND difference images to the excess mass contours, we find that the 2 sigma contour level used to define the forerunner front is readily apparent in the images. In fact, this level generally outlines the leading edge of the visible event. If the contour plots of the SOLWIND events are made with the same (linear) contour spacing, a forerunner plateau is visible in both the CME itself and nearby affected coronal features, e.g., a neighboring streamer that has been pushed aside. If contour levels with power law spacing similar to the density distribution of the background corona are chosen, however, the forerunner plateau disappears. Therefore, we conclude that the forerunner phenomenon is an integral part of the coronal mass ejection itself and not a manifestation of precursor activity. GRA

N87-15153# California Univ., Irvine. Dept. of Physics.

DYNAMIC FORMATION OF STRESSED CORONAL MAGNETIC FIELDS Final Report, 2 Nov. 1984 - 2 Feb. 1986

R. S. Steinolfson Feb. 1986 19 p

(Contract F19628-85-K-0006)

(AD-A170176; AFGL-Tr-86-0062) Avail: NTIS HC A02/MF A01 CSCL 03/2

Magnetic fields in the quiescent solar corona usually remain connected to photospheric (subcoronal) fields. Since the ratio between the plasma and magnetic pressures satisifies beta somewhat $>$ 1 below the corona, the frozen in field in this high inertia region is easily moved about by the continual motion of the photospheric plasma. In the corona, however, beta somewhat $<$ 0.1 and magnetic effects dominate. The response of coronal fields to photospheric motion is simulated by subjecting a coronal magnetic cylinder, with an initially uniform axial field, to a radially varying twist at the end plastes. Azimuthal symmetry is assumed, and the time dependent MHD equations are solved numerically for a specified end plate rotation. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

N87-15154 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. Fuer Extraterrestrische Physik.

OPTICALLY THIN WINDS FROM NEUTRON STARS

R. Z. Yahel, W. Brinkmann, and A. Braun Apr. 1986 33 p Submitted for publication

(MPE-Preprint-50; ETN-87-98868) Copyright. Avail: Issuing Activity

Super-Eddington radiative fluxes generated in the helium burning shell of type-1 X-ray bursters are considered as the power source of radiation driven winds. Study of self-consistent radiation-hydrodynamic models of the atmospheres of bursting neutron stars shows that the bolometric flux from the wind is Eddington-limited,

independently of the total energy release. The spectrum differs from a black body, and the color temperature is small, less than or = 1 keV, due to the contribution of the cooler parts of the wind. Atomic transitions in the partially ionized iron Fe(+25) are observed, although it is not clear whether their signature appears as absorption line. General-relativistic effects associated with radiation emission are important, since hard photons (of few keV) are produced close to the initial stellar radius. ESA

N87-15155 Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. Fuer Extraterrestrische Physik.
THE 35 DAY CYCLE OF HER X-1: QUALITY OF THE CLOCK MECHANISM
Hakki Oegelman Jun. 1986 23 p Submitted for publication
(MPE-Preprint-54; ETN-87-98869) Copyright. Avail: Issuing Activity

The quality of the clock in the model of the 35 day cycle of Her X-1 is examined using data which extends the coverage to a span of 142 turnons. Autoregressive time series methods are applied to model the data. It is concluded that, in addition to the poor quality clock models with white period noise, an alternative possibility exists which implies that the intrinsic clock is good and that the turnon phase fluctuations can be modelled with white phase noise plus an integrating filter with 1.5 to 7 yr timescale. Arguments that associate this timescale with the mass transfer process from HZ Her are presented. ESA

N87-15156* Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
A SPECTRAL STUDY OF THE PERSISTENT X-RAY FLUX FROM 4U/MXB 1636-53
W. D. Vacca, M. Sztjno, W. H. G. Lewin, J. Truemper, J. vanParadijs, and A. Smith Jul. 1986 40 p Submitted for publication Sponsored by NASA, Deutshcer Akademischer Austauschdienst, Alexander von Humboldt Stiftung, and the John Simon Guggenheim Memorial Foundation
(MPE-Preprint-57; ETN-87-98871) Copyright. Avail: Issuing Activity CSCL 03B

The X-ray burst source 4U/MXB 1636-53 was continuously observed with EXOSAT for 25 hr. No standard one-component spectral model provides an acceptable representation of all the data. However, almost all complex one-component and two-component models accurately fit the data. A black body plus a multicolor disk spectrum does not fit the data. Two-component spectral models can be fitted to the data with more than one set of different parameter values. It is suggested that physical scenarios to interpret two-component spectra of low-mass X-ray binaries may be based on mathematical parameterizations which do not provide unique representations of the data, and that the two-component mathematical fits may not have any real physical significance. ESA

99 GENERAL

N87-15157 National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
[ACTIVITIES REPORT OF THE DIVISION OF RADIATION SCIENCE AND ACOUSTICS] Annual Report, 1985
Feb. 1986 80 p
(ETN-86-98616) Copyright. Avail: Issuing Activity

Research in dosimetry (X-ray dosimetry, protection level dosimetry, chemical dosimetry, linear accelerator, high-energy dosimetry); radioactivity and neutron measurements (neutron source measurements, neutron dosimetry, neutron fluence standards, accelerator facilities, electronics and on-line computing, health physics, absolute counting and standards of radioactivity, nuclear spectrometry and nuclear data); and acoustics (acoustical standards, noise and speech technology, ultrasonics and underwater acoustical standards) is summarized. ESA

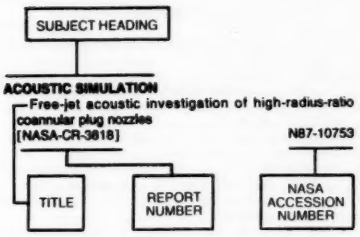
N87-15158# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES, VOLUME 40, NUMBER 11/12 Monthly Report
C. J. Fox Dec. 1986 87 p
(AD-A173371; ESN-40-11/12) Avail: NTIS HC A05/MF A01 CSCL 05/2

European Science Notes is a monthly publication with brief articles on recent developments in European scientific research. Partial contents: International Society of Political Psychology conference; 2nd International Workshop on Neuroimmunomodulation; ESPRIT(European Strategic Program for R+D in Information Technology) update; The Second Alvey Conference; International Conference on Optical and Millimeter Wave Propagation and Scattering in the Atmosphere; Ion Beam Modification of Materials; Tribology Research at the Metal Research Institute of TNO; European Turbulence Conference; Fluid Mechanics Research at Selected Portuguese Universities; Columbus Ocean Workshop; EARSEL (European Association of Remote Sensing laboratories); Satellite Observations of Ocean Color for Dynamics and Biological Studies; Laser Spectroscopy Serves Basic Research at the Univ. of Graz; The 6th European Symposium on Optoelectronics--A mixed bag. GRA

N87-15159# Centre National de Recherches de l'Espace, Brussels (Belgium).
SPACE RESEARCH IN BELGIUM
1986 45 p Presented at the 26th COSPAR Plenary Meeting, Toulouse, France, 30 Jun.-12 Jul. 1986
(ISSN-0772-9804; ETN-86-98576) Avail: NTIS HC A03/MF A01

Spacelab 1 experiments (grille spectrometer, solar spectrum from 1700 to 3200 nm, Lyman alpha measurements); EURECA occultation radiometer; the MAP/GLOBUS atmospheric chemistry campaigns are discussed. Also discussed are: stratospheric ion composition measurements; the ionosphere and magnetosphere; the solar wind; and planetary insolation. ESA

Typical Subject Index Listing



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A

A-320 AIRCRAFT
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725
ABLATION
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
ABRASION
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445
ABSORPTION SPECTRA
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
Milky Way halo gas kinematics N87-15088
6 CM OH absorption in megamaser galaxies N87-15095
The organic component of interstellar grains N87-15114
Translucent molecular clouds: Theory and observations N87-15117
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124
ABSORPTIVITY
The relation of bacterial absorptivity in the 3 to 4 micron waveband to observations of GC-IRS7 and sundry comments — infrared spectra
[PREPRINT-108] N87-15037
Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106
ABSTRACTS
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
Parallel matrix computations
[AD-A170699] N87-14923
Organizations as information processing systems
[AD-A173362] N87-15026
ABUNDANCE
Infrared spectra of WC10 planetary nebulae nuclei N87-15075
Planetary nebulae and the interstellar medium N87-15076
The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093
Is OH abundance enhanced in tidally distorted galaxies? N87-15094
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124
ACCESS CONTROL
Performance evaluation and control of distributed computer communication networks
[AD-A170810] N87-14579
A review of methods of personal identity verification — computer information security
[NPL-DITC-73/86] N87-15022
ACCIDENTS
Deep stall characteristics of MU-300
[NASA-TM-88502] N87-14318
Space shuttle accident
[S-HRG-99-967] N87-14369
ACCRETION DISKS
Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
Magnetic braking in weakly ionized circumstellar disks N87-15129
ACCURACY
Study and implementation of torque wrench calibrating apparatus
[CETIM-103-480] N87-14679
ACETYLENE
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N87-14516
ACOUSTIC ATTENUATION
The application of ultrasonic attenuation spectral analysis to materials characterisation
[AERE-R-11885] N87-14755
ACOUSTIC EMISSION
Acoustic emission analysis of Carbon Fiber Reinforced Plastics (CFRP) N87-14440
Acoustic emission frequency discrimination
[NASA-CASE-MSC-20467-1] N87-14676
ACOUSTIC EXCITATION
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14666
ACOUSTIC SCATTERING
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794
ACOUSTICS
Measurement of pressure fluctuations on the wall of a turbulent combustion furnace
[ONERA-RTS-47/7104-EY] N87-14478
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
Activities report of the Institute of Sound and Vibration Research
[ETN-86-98365] N87-14745
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157
ACTIVATION ENERGY
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021
ACTIVE CONTROL
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910
ADA (PROGRAMMING LANGUAGE)
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
ADDITIVES
Optimization of spectrographic trace analysis N87-14455
Advanced high temperature coating systems beyond current state of the art systems
[AD-A170192] N87-14523
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535
ADHESION
Model for bimetallic interfaces
[DE86-702901] N87-14500
Advanced high temperature coating systems beyond current state of the art systems
[AD-A170192] N87-14523
ADHESION TESTS
Elucidation of the adhesion mechanisms in structural aluminum bondings
[BMFT-FB-W-86-008] N87-14534
ADHESIVE BONDING
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
ADSORPTION
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
AERIAL PHOTOGRAPHY
An extended mathematical model of aerotriangulation for highly precise point determination
[SER-C-316] N87-14762
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170684] N87-14767
AEROACOUSTICS
High-speed propeller noise predictions: Effects of boundary conditions used in blade loading calculations
[NASA-TM-88913] N87-14957
AERODYNAMIC CHARACTERISTICS
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Aerodynamic characteristics of general aviation at high angle of attack with the propeller slipstream
[NASA-TM-88503] N87-14280
Compressibility effects on flows around simple components N87-14642
AERODYNAMIC CONFIGURATIONS
Design of profiles for cascades N87-14340
Supercritical blade cascade design N87-14342
AERODYNAMIC FORCES
Modeling three dimensional vortex flow in aerodynamics N87-14636
AERODYNAMIC INTERFERENCE
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-989] N87-14295
AERODYNAMIC NOISE
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
Noise development in transonic flows at the impact of vortices on a profile leading edge
[MPIS-5/1986] N87-14960

AERODYNAMIC STABILITY
Vehicle geometry effects on hypersonic stability and control N87-14397
AERODYNAMIC STALLING
Deep stall characteristics of MU-300
[NASA-TM-88502] N87-14318
AERODYNAMICS
Aeronautical Engineering: A continuing bibliography with indexes (supplement 207)
[NASA-SP-7037(207)] N87-14245
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
AERONAUTICAL ENGINEERING
Aeronautical Engineering: A continuing bibliography with indexes (supplement 207)
[NASA-SP-7037(207)] N87-14245
On a data base system for numerical simulator N87-14252
Application of computational aerodynamics to wing design under fuselage interference N87-14276
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277
A method for the manufacture of model helicopter rotor blades from glass fiber reinforced plastic
[RAE-TR-85040] N87-14316
CFD in the automobile industry — computational fluid dynamics (CFD)
[CFDU/86/7] N87-14659
AEROSOLS
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
Two Phase Flows in Major Technological Hazards, volume 2 — conference
[VKI-LS-1986-03-VOL-2] N87-14544
Formation and dynamics of aerosols N87-14546
Transport of toxic material in aerosol phase N87-14547
Numerical modeling of aerosols N87-14548
AEROSPACE ENGINEERING
Evaluation of functions and interfaces for computer aided engineering in support of space systems design, management study
[ESA-CR(P)-2222] N87-14901
AEROSPACE ENVIRONMENTS
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Rocket exhaust plume flow into space N87-14403
AEROSPACE SYSTEMS
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170215] N87-14493
AEROSPACEPLANES
An overview of the British Aerospace HOTOL transatmospheric vehicle
[NASA-TM-88008] N87-14317
AEROSTATICS
Balloon instrumentation engineering and development
[AD-A170225] N87-14678
AEROTHERMODYNAMICS
Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives
[ETN-87-98751] N87-14331
Jet mixing low — supersonic air flow N87-14339
Combined propulsion systems, aerothermodynamic processes and an evaluation study of propulsion components and systems N87-14345
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Prediction methods for the calculation of flow fields around reentry vehicles N87-14395
AFTERBODIES
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292
AFTERGLOWS
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796
AGGLOMERATION
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model
[AD-A169495] N87-14490
AGGREGATES
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model
[AD-A169495] N87-14490
AGING (MATERIALS)
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels
[BLL-CE-TRANS-8252-(9022.09)] N87-14481
AGRICULTURE
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
AIR
Combustion process of hydrogen-air mixtures under technical conditions N87-14338
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145
AIR DEFENSE
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230620] N87-15023
AIR DROP OPERATIONS
C-130/C-141 center vertical restraint
[AD-A170438] N87-14320
AIR FLOW
Jet mixing low — supersonic air flow N87-14339
AIR POLLUTION
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784
Laser-photoacoustic spectroscopy of air pollutants
[M-19] N87-14787
AIR TRAFFIC CONTROL
Activities report in air traffic control
[ETN-87-98861] N87-14309
Evaluation of methods for coordination of software technological tasks using examples of the Spacelab program and air surveillance program. Part 3: Experience report for a software project for air surveillance
[BMFT-FB-DV-86-005] N87-14898
AIR TRAFFIC CONTROLLERS (PERSONNEL)
The simulator: The perfect illusion — flight simulator
[FACHTHEMEN-9] N87-14354
AIRBORNE EQUIPMENT
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
Determination of atmospheric parameters by an airborne backscatter probe
[ESA-TT-982] N87-14822
AIRBORNE INFECTION
Some evidence on non-transmissibility of acute upper respiratory disease and related matters
[PREPRINT-115] N87-14842
AIRBORNE/SPACEBORNE COMPUTERS
CADISS: An onboard system for compression and decompression of imagery sensor signals
[NLR-MP-85045-U] N87-14868
AIRCRAFT ACCIDENT INVESTIGATION
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982
[NASA-TM-88007] N87-14305
AIRCRAFT ACCIDENTS
Accidents to UK aircraft and to large jet and turbo-prop transport aircraft worldwide in 1984
[CAA-PAPER-85009] N87-14297
Human factors in accidents due to controlled flight into the ground
[CAA-PAPER-85015] N87-14298
Accidents to United Kingdom aircraft and to large jet and turbo-prop transport aircraft worldwide in 1985
[CAA-PAPER-86005] N87-14301
AIRCRAFT CONSTRUCTION MATERIALS
First International Conference Materials in Aerospace
[BAE-S85/AMR/0080] N87-14243
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444
Information notice about the repair of composite structures
[STPA-42744] N87-14447
Elementary characterization of the AS4/2220.3 Hercules prepreg
[CEAT-M4-475-000] N87-14448
Study of the Ti 15-3-3 titanium alloy in thin plate form
[SNIAS-45-656] N87-14510
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725
AIRCRAFT DESIGN
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
Transonic wing and airfoil design using inverse code WINDES N87-14275
Application of computational aerodynamics to wing design under fuselage interference N87-14276
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277
An overview of the British Aerospace HOTOL transatmospheric vehicle
[NASA-TM-88008] N87-14317
Deep stall characteristics of MU-300
[NASA-TM-88502] N87-14318
Development of a technology for increasing payload of existing aircraft (NEW 2)
[BMFT-FB-W-86-007] N87-14328
Vehicle geometry effects on hypersonic stability and control N87-14397
AIRCRAFT ENGINES
Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives
[ETN-87-93751] N87-14331
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
AIRCRAFT HAZARDS
Numerical simulation of an aircraft icing N87-14248
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325
AIRCRAFT INSTRUMENTS
Auditory warnings on the BAC 1-11 and the Boeing 747. An application of the guidelines of CAA Paper 82017
[CAA-PAPER-85004] N87-14303
A simulated instrument, serial bus system — aircraft instruments
[LM/TR/654/2/2] N87-14329
AIRCRAFT LANDING
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
AIRCRAFT MAINTENANCE
An assessment of aircraft repair schemes for battle damage and permanent usage
[R946/8] N87-14246
Information notice about the repair of composite structures
[STPA-42744] N87-14447
AIRCRAFT MODELS
Laboratory tests of the sensors of the Steinheil-Lear Siegler Strapdown Measurement Unit model 1903-SB for model attitude measurements in a wind tunnel
[DFVLR-MITT-86-15] N87-14682
AIRCRAFT NOISE
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
Noise disturbance at night near Heathrow and Gatwick airports: 1984 check study — London airports
[DR-8513] N87-14781
CEC joint study of community response to aircraft noise 1984: Main report. The influence of residual noise on disturbance from aircraft noise — Commission of the European Communities (CEC)
[DR-8601] N87-14782
Noise certification and noise sensitivity studies on the BO-105 helicopter
[DFVLR-MITT-86-13] N87-14958
AIRCRAFT RELIABILITY
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
Fault detection sensitivity in thick light alloy specimens, test report
[REPT-47-084/F] N87-14721
AIRCRAFT SAFETY
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982
[NASA-TM-88007] N87-14305
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
AIRCRAFT STRUCTURES
Reliability of in-service inspection of transport aircraft structures
[CAA-PAPER-85013] N87-14244
An assessment of aircraft repair schemes for battle damage and permanent usage
[R946/8] N87-14246
Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures — aircraft structures
[DFVLR-MITT-86-09] N87-14437
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859

AIRFOIL PROFILES
Design of profiles for cascades N87-14340
Study of double exposure holography of the 3-dimensional character of the flow around an airfoil profile in a wind tunnel
[NASA-TM-88486] N87-14673
Noise development in transonic flows at the impact of vortices on a profile leading edge
[MPIS-5/1986] N87-14960

AIRFOILS
Development of the highly loaded axial flow turbine airfoils, making use of the improved inverse channel flow design method N87-14257
An easily vectorizable numerical solution of the Euler equations N87-14258
Application of the e sup N method to calculations of laminar flow control N87-14263
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
Transonic aileron computation in comparison to wind tunnel test N87-14273
A verification of unsteady Navier-Stokes solutions around oscillating airfoils
[NASA-TM-88341] N87-14279
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Development of a technology for increasing payload of existing aircraft (NEW 2)
[BMFT-FB-W-86-007] N87-14328

AIRFRAMES
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods
[AD-A170327] N87-14319
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170218] N87-14493

AIRPORTS
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
Noise disturbance at night near Heathrow and Gatwick airports: 1984 check study — London airports
[DR-8513] N87-14781
CEC joint study of community response to aircraft noise 1984: Main report. The influence of residual noise on disturbance from aircraft noise — Commission of the European Communities (CEC)
[DR-8601] N87-14782
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792

ALGAE
Photobiological hydrogen production in green algae and photosynthetic bacteria
[DE86-015918] N87-14833

ALGORITHMS
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249
Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875
Reduced tolerance imaging I
[AD-A170932] N87-14882
Surface reconstruction from planar contours
[AD-A171617] N87-14884
The complexity of parallel algorithms
[AD-A172445] N87-14885
The cleaning person algorithm — B programming language
[CWI-CS-R8610] N87-14889
The power of the queue — computer storage models
[CWI-CS-R8612] N87-14890
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-98591] N87-14904
Systolic networks for the solution of linear problems
[ETN-87-98589] N87-14909
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915
Parallel matrix computations
[AD-A170699] N87-14923
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941

ALIGNMENT
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754

ALLOCATIONS
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875
Optimal allocation of multistate components
[AD-A170081] N87-14937

ALLOYS
Model for bimetallic interfaces
[DE86-702901] N87-14500

ALLUVIUM
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879

ALPINE METEOROLOGY
Forcing mechanisms of mountain-valley circulations in the Inn-Valley (Alps)
[DFVLR-FB-86-28] N87-14802

ALUMINUM ALLOYS
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys
[AD-A170136] N87-14491
Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
The effect of process parameters on the internal quality of an aluminum die casting
[ETN-86-98703] N87-14556
The continuous production of stir cast material
[ETN-87-98701] N87-14557
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714
Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate
[NLR-MP-85082-U] N87-14744

ALUMINUM CARBIDES
Production of aluminum-silicon carbide composites
[ETN-86-98696] N87-14446

ALUMINUM COATINGS
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-88840] N87-14488

ALUMINUM COMPOUNDS
Thermal extraction of krypton in aluminum using a mass spectrometer N87-14462
Elucidation of the adhesion mechanisms in structural aluminum bondings
[BMFT-FB-W-86-008] N87-14534

ALUMINUM FLUORIDES
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526

ALUMINUM OXIDES
Structural features of corundum color varieties by spectroscopic methods N87-14481
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525

AMBIPOLAR DIFFUSION
Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127
Magnetic braking in weakly ionized circumstellar disks N87-15129

AMMONIUM NITRATES
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537

AMORPHOUS MATERIALS
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477
High-temperature effect of hydrogen on sintered alpha-silicon carbide
[NASA-TM-88819] N87-14518
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California
[AD-A170066] N87-14522

AMORPHOUS SEMICONDUCTORS
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016

AMPLIFIER DESIGN
Low phase noise oscillator
[NASA-CASE-GSC-13018-1] N87-14596
Pulse amplifier with high common-mode rejection
[DIGEL-70] N87-14615

AMPLIFIERS
Low phase noise oscillator
[NASA-CASE-GSC-13018-1] N87-14596

AMPLITUDES
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14589

ANALOG TO DIGITAL CONVERTERS
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591

ANALYSIS (MATHEMATICS)
Optimal allocation of multistate components
[AD-A170081] N87-14937

ANALYTICAL CHEMISTRY
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170336] N87-14524

ANGLE OF ATTACK
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647

ANGLES (GEOMETRY)
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757

ANGULAR MOMENTUM
Magnetic braking in weakly ionized circumstellar disks N87-15129

ANIMALS
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830

ANIONS
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021

ANISOTROPY
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne
[MPIS-2/1986] N87-14475
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008

ANNEALING
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14508
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941

ANNUAL VARIATIONS
World weather extremes: Revision
[AD-A170138] N87-14810
Development of Test Reference Years (TRY) for climatic regions in the Federal Republic of Germany
[BMFT-FB-T-86-051] N87-14818

ANODES
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540

ANODIC COATINGS
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14508

ANOMALIES
World weather extremes: Revision
[AD-A170138] N87-14810
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924

ANTENNA COMPONENTS
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
A log - periodic HF antenna system
[AD-D012527] N87-14581

ANTENNA DESIGN
Development of the 15 meter diameter hoop column antenna
[NASA-CR-4038] N87-14366
A practical guide to the design of rhombic aerials
[RAE-TM-RAD-NAV-266] N87-14566
A log - periodic HF antenna system
[AD-D012527] N87-14581
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
Antenna optimization for Alfven wave heating
[IPP-4/228] N87-14592
ANTENNA RADIATION PATTERNS
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
ANTHROPOMETRY
Anthropometry handbook
[AD-A170298] N87-14855
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857
ANTIFRICTION BEARINGS
Development of a suitable powder metal on iron base for general use in highly loaded slide bearings
[BMFT-FB-T-86-056] N87-14507
ANTIMISSILE DEFENSE
Phased Array Laser System (PALS)
[AD-A169635] N87-14689
ANTIREFLECTION COATINGS
Design, analysis and test verification of advanced encapsulated systems
[NASA-CR-177076] N87-14619
Ion assisted deposition of optical coatings
[AD-A170572] N87-14977
APPLICATIONS OF MATHEMATICS
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
APPLICATIONS PROGRAMS (COMPUTERS)
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703
MORE operating system: A message oriented resource environment
[DE86-013932] N87-14887
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915
APPROXIMATION
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
ARC JET ENGINES
Electric propulsion options for the SP-100 reference mission
[NASA-TM-88918] N87-14422
ARC WELDING
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
Pulsed MIG welding, text
[ETN-87-98699] N87-14716
ARCHITECTURE (COMPUTERS)
Fault tolerance in parallel architectures
[AD-A170245] N87-14864
MORE operating system: A message oriented resource environment
[DE86-013932] N87-14887
ARGON PLASMA
Methods of plasma excitation
[AD-A170347] N87-15002
ARIANE LAUNCH VEHICLE
Extendable nozzle for the HM60 rocket engine — Ariane 5 N87-14398
Fluid dynamic problems in the HM60 (Vulcain) cryogenic turbopump — Ariane 5 N87-14399
Aerodynamic design and test of a supersonic turbine for a rocket engine — Ariane 5 N87-14400
ARMED FORCES (UNITED STATES)
Trilevel interaction design model for pilot part-task training
[DE86-012426] N87-14850
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857
ARRAYS
Design of Programmable Logic Arrays (PLA) CMOS
[ETN-87-98590] N87-14617
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Radiation from an element in an array to its surroundings, appendix C N87-14624
ARTIFICIAL INTELLIGENCE
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170884] N87-14767
Conceptual clustering using relational information
[AD-A170874] N87-14911
Location of the communication process network described in FP2 on a graph structure in order to implement the parallel processing of that language
[RR-606-IMAG-49-LIFIA-I] N87-14914
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170830] N87-15025
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033
ARTIFICIAL SATELLITES
Nonsingular parametric expressions for orbit propagation by theoretical estimation of parameters
[INPE-4024-TDL/241] N87-14360
Orbit calculation for artificial Earth satellites
[GKSS-86/E/21] N87-14365
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417
Calibration of ETS videotapes
[AD-A168888] N87-14677
ASCENT PROPULSION SYSTEMS
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430
ASCENT TRAJECTORIES
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915
ASPHALT
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554
ASSEMBLIES
Emitted vibration measurement device and method
[NASA-CASE-MFS-25961-1] N87-14670
ASTRONAUTS
Radiation effects in space
[DE86-013257] N87-14841
ASTRONOMICAL MAPS
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
HC3N maps of OMC1 N87-15056
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
Filamentary structure in the Orion molecular cloud N87-15058
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
The bird: A pressure-confined explosion in the interstellar medium N87-15062
ASTRONOMICAL MODELS
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049
Models of polarized infrared emission from bipolar nebulae N87-15050
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131
Double layers and circuits in astrophysics
[NASA-CR-180018] N87-15136
ASTRONOMICAL PHOTOGRAPHY
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
ASTRONOMY
Extraterrestrial research in the Federal Republic of Germany
[NASA-TM-88010] N87-14358
ASTROPHYSICS
Extraterrestrial research in the Federal Republic of Germany
[NASA-TM-88010] N87-14358
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
ASYMPTOTIC METHODS
Asymptotic analysis of corona discharge from thin electrodes
[NASA-TP-2645] N87-14998
ATLANTIC OCEAN
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826
ATMOSPHERIC ATTENUATION
Uplink power control of satellite Earth stations as a fade-countermeasure of 20/30 GHz communication systems N87-14564
Development of the design concept for a variable rate system for the 30/20 GHz Olympus trial N87-14565
ATMOSPHERIC BOUNDARY LAYER
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808
ATMOSPHERIC CHEMISTRY
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
Determination of the technical degradation of nitrogen oxides in the atmosphere
[BPT-3/86] N87-14785
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14788
Space research in Belgium
[ISSN-0772-9804] N87-15159
ATMOSPHERIC CIRCULATION
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
Numerical simulations of the circulation of the eastern Mediterranean
[AD-A170219] N87-14825
ATMOSPHERIC COMPOSITION
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798
ATMOSPHERIC DIFFUSION
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784
ATMOSPHERIC EFFECTS
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786
Visibility of signal lights under atmospheric effects
[ESA-TT-987] N87-14992
ATMOSPHERIC MODELS
A simulation feasibility study
[AD-A169651] N87-14793
Stability of a shear model in which perturbations move with the mean local flow
[PB86-232469] N87-14805
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
Results from prediction of cloudiness with a limited area model
[DM-48] N87-14821
ATMOSPHERIC OPTICS
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798

Visibility of signal lights under atmospheric effects
[ESA-TT-967] N87-14992

ATMOSPHERIC PHYSICS
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812

ATMOSPHERIC SOUNDING
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791
Determination of atmospheric parameters by an airborne backscatter probe
[ESA-TT-982] N87-14822

ATMOSPHERIC TEMPERATURE
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806

ATMOSPHERIC TURBULENCE
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353

ATOMIC BEAMS
Spectroscopy of the phonons on noble gas surfaces using helium atomic beam scattering
[MPIS-1/1986] N87-14968

ATOMIC SPECTRA
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457

ATTENTION
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852

ATTITUDE CONTROL
Emitted vibration measurement device and method
[NASA-CASE-MFS-25981-1] N87-14670

ATTITUDE INDICATORS
Laboratory tests of the sensors of the Steinheil-Lear Siegler Strapdown Measurement Unit model 1903-SB for model attitude measurements in a wind tunnel
[DFVLR-MITT-86-15] N87-14682

ATTITUDE STABILITY
Forced motion on spinning test for slosh-moment investigations — spacecraft stability N87-14406

AUDIOLOGY
Activities report of the Institute of Sound and Vibration Research
[ETN-86-98365] N87-14745

AUDITORY SIGNALS
Auditory warnings on the BAC 1-11 and the Boeing 747. An application of the guidelines of CAA Paper 82017
[CAA-PAPER-85004] N87-14303

AUGER SPECTROSCOPY
Special techniques for the Auger analysis of microelectronic devices
[AD-A171631] N87-14603

AURORAL ZONES
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791

AURORAS
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795

AUSTENITIC STAINLESS STEELS
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503

AUTOMATA THEORY
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908

AUTOMATIC CONTROL
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712
Further developments of the Solid State Automated Microscope (SSAM)
[ETN-87-98693] N87-14991

AUTOMATIC PICTURE TRANSMISSION
Automatic picture transmission receivers for weather satellite images. A brief introduction and survey of some commercially-available equipment
[AD-A170359] N87-14574

AUTOMATIC TEST EQUIPMENT
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98566] N87-14871

AUTOMOBILES
Effects of boundary conditions in numerical experiments for turbulent flows N87-14285
CFD in the automobile industry — computational fluid dynamics (CFD)
[CFDU/86/7] N87-14659

AUTONOMOUS NAVIGATION
Autonomous vehicle navigation
[AD-A170379] N87-14311
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033

AVIONICS
A simulated instrument, serial bus system — aircraft instruments
[LM/TR/654/2/2] N87-14329

AXIAL FLOW
SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide
[NLR-TR-84128-U] N87-14288

AZOLES
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538

B

BACILLUS
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834

BACKSCATTERING
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Determination of atmospheric parameters by an airborne backscatter probe
[ESA-TT-982] N87-14822

BACTERIA
Photobiological hydrogen production in green algae and photosynthetic bacteria
[DE86-015918] N87-14833

BALL BEARINGS
Analysis of DRIRU bearings and lubricant from solar max repair mission N87-14379

BALLOON-BORNE INSTRUMENTS
German-Austrian stellar triangulation project using balloon sondes
[SER-B-278] N87-14758
German-Austrian stellar triangulation project using balloon sondes. Development and purpose of the project N87-14759
German-Austrian stellar triangulation project using balloon sondes. Engineering and observations N87-14760
German-Austrian stellar triangulation project using balloon sondes. Evaluation of observations and analysis of the results N87-14761

BALLOONS
Balloon instrumentation engineering and development
[AD-A170225] N87-14678

BANACH SPACE
Limiting behavior of linearly damped hyperbolic equations
[AD-A170161] N87-14920
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations
[AD-A170187] N87-14921

BAND STRUCTURE OF SOLIDS
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013

BANDWIDTH
Adaptive TDMA as a means of trading power against bandwidth — satellite transmission N87-14563
High bandwidth analog applications of photonics: Present capabilities and future possibilities
[DE86-014999] N87-14582

BARRIER LAYERS
Quantum well electron barrier diode
[AD-D012432] N87-14600

BASE PRESSURE
Base pressure control for aerospace vehicles N87-14412

BAYES THEOREM
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934

BEAMS (RADIATION)
Phased Array Laser System (PALS)
[AD-A169635] N87-14689

BEAMS (SUPPORTS)
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413

BEARING
Emitted vibration measurement device and method
[NASA-CASE-MFS-25981-1] N87-14670

BEARINGS
The deduction of bearing forces in rotating machinery — ship machinery
[BR99858] N87-14372

BEHAVIOR
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830
Compendium of research
[AD-A170356] N87-15024
Organizations as information processing systems
[AD-A173362] N87-15026

BELGIUM
Space research in Belgium
[ISSN-0772-9804] N87-15159

BENDING FATIGUE
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731

BENDING MOMENTS
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731
Tearing of circumferential cracks in pipes loaded by bending
[AD-A170429] N87-14734

BESSEL FUNCTIONS
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978

BIAS
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654

BIBLIOGRAPHIES
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[NASA-SP-7037(207)] N87-14245
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[CAA-PAPER-86003] N87-14300
Research activities of the National Institute for Materials Research, 1985
[DE86-702765] N87-14436
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
Parallel matrix computations
[AD-A170699] N87-14923
Organizations as information processing systems
[AD-A173362] N87-15026

BILLETS
The continuous production of stir cast material
[ETN-87-98701] N87-14557

BIMETALS
Model for bimetallic interfaces
[DE86-702901] N87-14500

BINARY DATA
Binary time series with reward. Application to climatology modeling
[ETN-87-98588] N87-14950

BINARY STARS
The 35 day cycle of Her X-1: Quality of the clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155

BINOMIAL COEFFICIENTS
Lower bounds for a class of Kostka numbers
[CWI-CS-R8614] N87-14925

BIOCHEMISTRY
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931

BIOLOGICAL EFFECTS
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834

BIOLOGICAL EVOLUTION
On deliberate misreferencing as a tool of science policy
[PREPRINT-125] N87-15027

BIOLOGICAL MODELS (MATHEMATICS)
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946

BIOMASS
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425
BIOMASS ENERGY PRODUCTION
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539
BIPOLAR TRANSISTORS
Development of a planar heterojunction bipolar transistor for very high speed logic
[AD-A170063] N87-15010
BIRD-AIRCRAFT COLLISIONS
Analysis of bird strikes reported by European airlines 1976-1980. Civil aircraft over 5700 kg (12 500 lb) maximum weight
[CAA-PAPER-84019] N87-14296
Analysis of bird strikes to United Kingdom registered aircraft 1983 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-85018] N87-14299
Analysis of bird strikes to United Kingdom aircraft 1984 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-86006] N87-14302
BIT ERROR RATE
Adaptive transmission rate and variable redundancy systems as a fade countermeasure — satellite communication N87-14562
BLACK AND WHITE PHOTOGRAPHY
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170884] N87-14767
BLOOD CIRCULATION
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
BLOOD PRESSURE
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832
BLOWOUTS
Discharges of saturated liquefied gases from pressure vessels N87-14545
BLUFF BODIES
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
BLUNT BODIES
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
BLUNT TRAILING EDGES
Investigations of the wake in a flow parallel to plates with blunt trailing edges
[MPIS-3/1986] N87-14293
BO-105 HELICOPTER
Noise certification and noise sensitivity studies on the BO-105 helicopter
[DFVLR-MITT-86-13] N87-14958
BOATTAILS
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
BODY MEASUREMENT (BIOLOGY)
Anthropometry handbook
[AD-A170298] N87-14855
BODY TEMPERATURE
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856
BODY WEIGHT
Helicopter passenger weigh survey, conducted at Aberdeen Airport, November 1984
[CAA-PAPER-85005] N87-14853
Anthropometry handbook
[AD-A170298] N87-14855
BODY-WING CONFIGURATIONS
Application of computational aerodynamics to wing design under fuselage interference N87-14276
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278
BOLTS
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444
Eddy current automation. Discrimination and selection software applied to hardness control
[CETIM-100-090] N87-14722
BOMBER AIRCRAFT
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set — X-band SLAR
[CNES-85/187T/CT/DRT/TIT/RL] N87-14828
BORON
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
BOUNDARY LAYER CONTROL
Application of the e sup N method to calculations of laminar flow control N87-14263
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
BOUNDARY LAYER EQUATIONS
Application of the e sup N method to calculations of laminar flow control N87-14263
BOUNDARY LAYER FLOW
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648
Study of phenomena of unsteady boundary-layer separation
[AD-A170428] N87-14649
Measurements of the low-wave-number structure of a turbulent boundary layer
[IC-AERO-85-01] N87-14657
Criteria for separation in two-dimensional steady and unsteady compressible flow
[ESA-TT-985] N87-14668
BOUNDARY LAYER SEPARATION
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[AD-A170157] N87-14286
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647
Study of phenomena of unsteady boundary-layer separation
[AD-A170428] N87-14649
Bubble dynamics and cavitation inception theory
[AD-A170603] N87-14650
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14665
BOUNDARY LAYER STABILITY
Experience about the application and valuation of roughness strips for boundary layer transition control in wind tunnel tests in the high-speed range
[DFVLR-MITT-86-12] N87-14291
Experimental investigations on the stability and transition of three-dimensional boundary layers
[DFVLR-FB-86-24] N87-14664
BOUNDARY LAYER TRANSITION
Experimental investigations on the stability and transition of three-dimensional boundary layers
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BOUNDARY VALUE PROBLEMS
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
Implicit time-marching methods for the transonic Euler equations N87-14254
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Development of supersonic computational aerodynamic program using panel method N87-14261
Effects of boundary conditions in numerical experiments for turbulent flows N87-14265
Bubble dynamics and cavitation inception theory
[AD-A170603] N87-14650
On contact problems of elasticity theory
[NASA-TM-88491] N87-14729
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924
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[CWI-CS-R8614] N87-14925
Stabilization of the Lax-Wendroff methods and a generalized one-step Runge-Kutta method for hyperbolic initial-value problems
[CWI-NM-R8613] N87-14929
BOXES (CONTAINERS)
Double window viewing chamber assembly
[NASA-CASE-MFS-28057-1] N87-14355
BRAIN
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838
BRAKES (FOR ARRESTING MOTION)
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703
BRANCHING (MATHEMATICS)
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
BRAYTON CYCLE
Brayton cycle solarized advanced gas turbine
[NASA-CR-179559] N87-15030
BREATHING APPARATUS
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
BRIGHTNESS
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967
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[NASA-CR-177900] N87-15150
BRIGHTNESS DISTRIBUTION
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BRIGHTNESS TEMPERATURE
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
BROADBAND
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414
Investigations on a broadband 180 deg hybrid — waveguide
[DFVLR-FB-86-22] N87-14616
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
BROMIDES
Methods of plasma excitation
[AD-A170347] N87-15002
BUBBLES
Bubble dynamics and cavitation inception theory
[AD-A170603] N87-14650
BUDGETS
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138
BUOYANCY
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629
BURNING RATE
Microwave measurement of the combustion velocity of solid propellants (4)
[ONERA-RTS-11/3173-EY] N87-14476
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
BURSTS
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
Optically thin winds from neutron stars
[MPE-PREPRINT-50] N87-15154
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 — X-ray burster
[MPE-PREPRINT-57] N87-15156
BUS CONDUCTORS
A simulated instrument, serial bus system — aircraft instruments
[LM/TR/654/2/2] N87-14329

C

CADMIUM COMPOUNDS
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007
CADMIUM FLUORIDES
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526
CADMIUM TELLURIDES
Preparation of a solvent zone crystallization experiment of cadmium telluride during the First SpaceLab Project (FSLP) Spacelab mission
[BMFT-FB-W-86-005] N87-14543
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008

CALIBRATING
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
Calibration of ETS videotapes
[AD-A168888] N87-14677
Study and implementation of torque wrench calibrating apparatus
[CETIM-103-480] N87-14679
Calibration of the fast 12-channel Electron Cyclotron Emission (ECE) spectrometer at Joint European Torus (JET)
[REPT-86-168] N87-14970
CAMERAS
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
Optical Gaussian convolvers
[AD-D012438] N87-14976
CANOPIES (VEGETATION)
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
CAPACITORS
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
CAPILLARY FLOW
Surface tension minimum and Marangoni convection — reduced gravity experiments N87-14409
CARBON
Carbon whisker study
[AD-A170345] N87-15012
CARBON DIOXIDE
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
CARBON DIOXIDE LASERS
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693
CARBON FIBER REINFORCED PLASTICS
Nondestructive tests of Carbon Fiber Reinforced Plastics (CFRP) in the framework of damage mechanics investigations N87-14438
Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Acoustic emission analysis of Carbon Fiber Reinforced Plastics (CFRP) N87-14440
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444
Elementary characterization of the AS4/2220.3 Hercules prepreg
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Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
CARBON FIBERS
Stress rupture of carbon fiber composite materials
[DE86-012854] N87-14443
CARBON MONOXIDE
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
Filamentary structure in the Orion molecular cloud N87-15058
CO near the Pleiades: Encounter of a star cluster with a small molecular cloud N87-15071
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
CARBON STARS
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077
Mass return to the interstellar medium from highly-evolved carbon stars N87-15078
Spectral characteristics of dust in carbon rich objects N87-15113
CARBON STEELS
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512
CARDIOVASCULAR SYSTEM
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
CARGO
C-130/C-141 center vertical restraint
[AD-A170438] N87-14320
Analysis of shock and vibration environments for cargo on C9B transport aircraft
[DE86-016101] N87-14322
CARGO AIRCRAFT
Analysis of shock and vibration environments for cargo on C9B transport aircraft
[DE86-016101] N87-14322
CASCADE FLOW
Design of profiles for cascades N87-14340
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341
Supercritical blade cascade design N87-14342
CASTING
The effect of process parameters on the internal quality of an aluminum die casting
[ETN-86-96703] N87-14556
The continuous production of stir cast material
[ETN-87-96701] N87-14557
CATALYSTS
Non-aqueous primary cell
[AD-D012428] N87-14599
CATHODE RAY TUBES
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14858
CATHODES
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485
Non-aqueous primary cell
[AD-D012428] N87-14599
CATIONS
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021
CAUCHY INTEGRAL FORMULA
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-989] N87-14295
CAUCHY PROBLEM
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
CAVITATION FLOW
Partial cavitation on pump blades N87-14401
Bubble dynamics and cavitation inception theory
[AD-A170603] N87-14650
CAVITIES
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792
CDC CYBER 205 COMPUTER
Three-dimensional Euler flow simulation on a Cyber 205 vector computer
[NLR-TR-85054-U] N87-14656
CELESTIAL BODIES
Calibration of ETS videotapes
[AD-A168888] N87-14677
CELESTIAL MECHANICS
Frozen orbits-near constant or beneficially varying orbital parameters
[AD-A170675] N87-14362
CENTRAL NERVOUS SYSTEM
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
CENTRIFUGAL COMPRESSORS
Scaled centrifugal compressor program
[NASA-CR-174912] N87-14349
CEPHEUS CONSTELLATION
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
CERAMIC COATINGS
Ceramic-ceramic shell tile thermal protection system and method thereof
[NASA-CASE-ARC-11641-1] N87-14442
CERAMIC FIBERS
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513
CERAMIC MATRIX COMPOSITES
Polymer precursors for ceramic matrix composites
[NASA-CR-179562] N87-14434
Fiber reinforced ceramic material
[NASA-CASE-LEW-14392-1] N87-14517
CERAMICS
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
Materials science in Europe
[AD-A170214] N87-14435
Research activities of the National Institute for Materials Research, 1985
[DE86-702765] N87-14436
Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods
[JUEL-CONF-55] N87-14450
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A166886] N87-14519
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California
[AD-A170066] N87-14522
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
High temperature properties and processes in ceramics: Thermomigration
[DE86-015035] N87-14531
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
Tools for high velocity surface milling of steels
[CETIM-106030] N87-14710
The modelling of creep for engineering design-1 — metals, ceramics
[NPL-DMA-A115] N87-14727
Micromechanics 2
[AD-A170560] N87-14735
CEREBRAL CORTEX
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
CEREBROSPINAL FLUID
The effect of changes in cerebrospinal fluid pressure on the labyrinth in terms of tympanic membrane displacement
[ISVR-TR-135] N87-14843
CERTIFICATION
Noise certification and noise sensitivity studies on the BO-105 helicopter
[DFVLR-MITT-86-13] N87-14958
CHALLENGER (ORBITER)
Post-Challenger assessment of space shuttle flight rates and utilization
[NASA-CR-180105] N87-14368
Space shuttle accident
[S-HRG-99-967] N87-14369
CHANGE DETECTION
On the pilot's behavior of detecting a system parameter change
[NASA-TM-88536] N87-14846
CHANNEL FLOW
Design of thin-gap channel flow cells
[DE86-016159] N87-14609
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629
CHARGE CARRIERS
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
CHARGE COUPLED DEVICES
New detector concepts — silicon radiation detectors
[MPE-PAE/EXP-E1-164] N87-14683
CHARGE TRANSFER
Hole transport and charge transfer in GaAs/InGaAs GaAs single strained quantum well structures
[DE86-016098] N87-15018
CHARGED PARTICLES
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961
CHARPY IMPACT TEST
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753

CHEBYSHEV APPROXIMATION
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936
CHEMICAL ANALYSIS
Analysis of micrometeorite material captured by the solar max satellite N87-14385
Examination of returned solar-max surfaces for impacting orbital debris and meteoroids N87-14386
A preliminary report on the study of the impact sites and particles of the solar maximum satellite thermal blanket N87-14387
Teflon, Kapton surface and bulk effects N87-14390
Analysis of normal and transparent silver Teflon N87-14391
Degradation studies of SMRM Teflon N87-14392
Advanced chemical analysis service at the Nuclear Research Center, Juelich, West Germany N87-14454
Analyses of the phosphate standard of the Egyptian Nuclear Materials Corporation (phosphate 1) N87-14459
Physical-chemical characterization of the 2220-3 resin in the AS4/2220-3 preimpregnated material, test report, part 1 — carbon-epoxy composite materials
[REPT-M4-475000-PT-1] N87-14533
Identification of polycyclic aromatic hydrocarbons N87-15098
The possible existence of interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099
CHEMICAL ATTACK
Degradation studies of SMRM Teflon N87-14392
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-86840] N87-14488
CHEMICAL BONDS
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
CHEMICAL COMPOSITION
Analysis of micrometeorite material captured by the solar max satellite N87-14385
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-86840] N87-14486
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N87-14516
Planetary nebulae and the interstellar medium N87-15078
Chemical evolution in spiral and irregular galaxies N87-15097
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112
The organic component of interstellar grains N87-15114
CHEMICAL DEFENSE
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
CHEMICAL LASERS
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
CHEMICAL PROPERTIES
Advanced chemical analysis service at the Nuclear Research Center, Juelich, West Germany N87-14454
CHEMICAL PROPULSION
Combined propulsion systems, aerothermodynamic processes and an evaluation study of propulsion components and systems N87-14345
CHEMICAL REACTIONS
Mass spectrometric concentration measurements in supersonic flows with chemical reactions N87-14334
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Teflon, Kapton surface and bulk effects N87-14390
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
CHEMICAL TESTS
Testing of high alloy steels for new hydrometallurgical processes and chemical plants
[BMFT-FB-T-86-055] N87-14506
CHEMICAL WARFARE
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
CHEMILUMINESCENCE
A precision laser spectrometer system
[AD-A170226] N87-14692
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796
CHIPS (ELECTRONICS)
Report on an interlaboratory electromigration experiment
[AD-A169652] N87-15006
CHLORIDES
The 5-(4-Ethynylophenoxy) isophthalic chloride
[NASA-CASE-LAR-13316-2] N87-14515
CHLOROPHYLLS
Methods of remote evaluation of chlorophyll concentration in the sea
[DRIC-T-7652] N87-14824
CHOLINE
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
CHROMATES
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007
CHROMIUM STEELS
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
CHROMOSPHERE
Molecular catastrophes and the formation of circumstellar dust N87-15116
CINEMATOGRAPHY
Progress in holographic cinematography
[ISL-CO-243/85] N87-14680
CIRCUIT PROTECTION
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
CIRCUIT RELIABILITY
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871
CIRCUITS
Eindhoven Schematic Editor (ESCHER) reference manual — electric circuit design
[EUT-86-E-157] N87-14897
Double layers and circuits in astrophysics
[NASA-CR-180018] N87-15136
CIRCULAR CYLINDERS
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
CIVIL AVIATION
Aerodynamic characteristics of general aviation at high angle of attack with the propeller slipstream
[NASA-TM-88503] N87-14280
Analysis of bird strikes reported by European airlines 1976-1980. Civil aircraft over 5700 kg (12 500 lb) maximum weight
[CAA-PAPER-84019] N87-14296
Accidents to UK aircraft and to large jet and turbo-prop transport aircraft worldwide in 1984
[CAA-PAPER-85009] N87-14297
Analysis of bird strikes to United Kingdom registered aircraft 1983 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-85018] N87-14299
Accidents to United Kingdom aircraft and to large jet and turbo-prop transport aircraft worldwide in 1985
[CAA-PAPER-86005] N87-14301
Analysis of bird strikes to United Kingdom aircraft 1984 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-86006] N87-14302
Deep stall characteristics of MU-300
[NASA-TM-86502] N87-14318
Helicopter passenger weigh survey, conducted at Aberdeen Airport, November 1984
[CAA-PAPER-85005] N87-14853
CLASSIFICATIONS
Conceptual clustering using relational information
[AD-A170874] N87-14911
Spectral evolution of young stellar objects N87-15066
CLEAR AIR TURBULENCE
Reduced tolerance imaging I
[AD-A170932] N87-14882
CLIMATE
Development of Test Reference Years (TRY) for climatic regions in the Federal Republic of Germany
[BMFT-FB-T-86-051] N87-14818
CLIMATOLOGY
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812
CLOUD COVER
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170899] N87-14768
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convectional meteorological variables
[AD-A169478] N87-14808
Results from prediction of cloudiness with a limited area model
[DM-48] N87-14821
CLOUD PHYSICS
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
CLUMPS
Conceptual clustering using relational information
[AD-A170874] N87-14911
The clumpy circumstellar medium around young supernova remnants N87-15079
The molecular gas in the supernova remnant IC443 N87-15080
CLUTTER
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577
CMOS
Contribution to the study of a monolithic 32 bit processor in CMOS technology
[ETN-87-98592] N87-14618
COAGULATION
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
COAL
A comparison of trace element analysis of whole coal by INAA and XRFS — instrument neutron activation analysis (INAA); X-ray fluorescence spectroscopy (XRFS) N87-14460
COASTS
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
COATINGS
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993
COCKPITS
Anthropometry handbook
[AD-A170298] N87-14855
COEFFICIENT OF FRICTION
Investigation of the influence of the impact friction coefficient on pneumatic conveying (Friction Pressure Loss (FPL) 304)
[BMFT-FB-W-86-009] N87-14711
COGNITION
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
COHERENT RADAR
Derivation of the radar range equation for a pulse-Doppler radar with range and velocity gating and coherent and noncoherent pulse integration
[AD-A170354] N87-14573
COLLAPSE
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
COLOR
Structural features of corundum color varieties by spectroscopic methods N87-14461
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
Postexperimental plots with a HP 7550A plotter
[DE86-015501] N87-14866
COLOR CODING
Design of filters for the vertical subsampling of color difference signals at half the sampling rate — color television
[FI-447-TB-19] N87-14587
COLOR PHOTOGRAPHY
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725

COLOR TELEVISION
Design of filters for the vertical subsampling of color difference signals at half the sampling rate — color television
[FI-447-TB-19] N87-14587
COLORIMETRY
Structural features of corundum color varieties by spectroscopic methods N87-14461
COMBAT
An assessment of aircraft repair schemes for battle damage and permanent usage
[R946/8] N87-14246
COMBINATORIAL ANALYSIS
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941
COMBUSTION
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Effect of the raw material composition of fabrics on the Limiting Oxygen Index (LOI)
[NASA-TM-88483] N87-14463
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648
COMBUSTION CHAMBERS
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25989-1] N87-14420
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426
Measurement of pressure fluctuations on the wall of a turbulent combustion furnace
[ONERA-RTS-47/7104-EY] N87-14478
Possibilities and problems of the calculation of flow phenomena in combustion chambers
[ETN-86-98745] N87-14713
COMBUSTION PHYSICS
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
Combustion process of hydrogen-air mixtures under technical conditions N87-14338
Oxygen index: An approximate value for the evaluation of combustion characteristics
[NASA-TM-88492] N87-14465
COMBUSTION STABILITY
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25989-1] N87-14420
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426
Microwave measurement of the combustion velocity of solid propellants (4)
[ONERA-RTS-11/3173-EY] N87-14476
COMET NUCLEI
Comet P/Halley 1910, 1986: An objective-prism study N87-15130
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149
COMET TAILS
Comet P/Halley 1910, 1986: An objective-prism study N87-15130
COMETS
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041
Organic grains in comets
[PREPRINT-122] N87-15137
COMMAND AND CONTROL
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580
COMMUNICATION CABLES
Cables and fire hazards
[NASA-TM-88493] N87-14553
COMMUNICATION EQUIPMENT
Development of a communication system compatible with chemical protective clothing and equipment
[NASA-CR-177040] N87-14861
COMMUNICATION NETWORKS
A user-oriented performance index for packet switched networks
[AD-A168903] N87-14570
COMMUNICATION SATELLITES
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
COMPACTING
Mechanistic understanding of powder compaction in metals
[AD-A170600] N87-14495
COMPARISON
Local interstellar gasdynamical stability in spiral arm flow N87-15092
COMPENSATORS
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[ESA-TT-979] N87-14352
COMPONENT RELIABILITY
Radiation effects on selected electronics parts from the solar max satellite N87-14377
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
COMPOSITE MATERIALS
Materials science in Europe
[AD-A170214] N87-14435
Information notice about the repair of composite structures
[STPA-42744] N87-14447
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California
[AD-A170066] N87-14522
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
COMPOSITE STRUCTURES
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731
Finite element modeling of electromagnetic propagation in composite structures
[NASA-TM-88916] N87-14956
COMPOSITION (PROPERTY)
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
COMPRESSIBILITY EFFECTS
Compressibility effects on delta wing flow fields N87-14641
Compressibility effects on flows around simple components N87-14642
COMPRESSIBLE BOUNDARY LAYER
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14661
COMPRESSIBLE FLOW
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341
A direct method for evaluating the disturbance fields of moving singularities at subsonic speeds in compressible media
[ESA-TT-977] N87-14667
Criteria for separation in two-dimensional steady and unsteady compressible flow
[ESA-TT-985] N87-14668
COMPRESSIVE STRENGTH
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171820] N87-14527
COMPUTATIONAL FLUID DYNAMICS
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
VP series hardware N87-14251
Database oriented UNIX operating environment and its application N87-14253
Three-dimensional potential flow simulations for transonic inlets N87-14255
Compressible flow analysis in turbomachinery N87-14256
An easily vectorizable numerical solution of the Euler equations N87-14258
A finite element method for high Reynolds number flow N87-14259
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Development of supersonic computational aerodynamic program using panel method N87-14261
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
Application of the e sup N method to calculations of laminar flow control N87-14263
Computational study of flow in curved pipes with circular-section N87-14264
Effects of boundary conditions in numerical experiments for turbulent flows N87-14265
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Direct numerical control in grid generation N87-14270
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
Computational study of three-dimensional wake structure N87-14272
Transonic aileron computation in comparison to wind tunnel test N87-14273
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Transonic wing and airfoil design using inverse code WINDES N87-14275
Application of computational aerodynamics to wing design under fuselage interference N87-14276
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277
Transonic and supersonic compressors N87-14344
Partial cavitation on pump blades N87-14401
Dynamic aspects of rocket plume impingement N87-14404
Formation and dynamics of aerosols N87-14546
Numerical modeling of aerosols N87-14548
Introduction to Vortex Dynamics, volume 1 — conference
[VKI-LS-1986-08-VOL-1] N87-14630
Fundamentals of vortex motion N87-14631
Review of vortex flows N87-14632
A three dimensional viscous vortex N87-14633
Introduction to Vortex Dynamics, volume 2 — conference
[VKI-LS-1986-VOL-2] N87-14637
Vortex breakdown theories N87-14639
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
Three-dimensional Euler flow simulation on a Cyber 205 vector computer
[NLR-TR-85054-U] N87-14656
Computational fluid dynamics in engineering and education
[CFDU/86/6] N87-14658
CFD in the automobile industry — computational fluid dynamics (CFD)
[CFDU/86/7] N87-14659
Possibilities and problems of the calculation of flow phenomena in combustion chambers
[ETN-86-98745] N87-14713
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
COMPUTATIONAL GRIDS
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Direct numerical control in grid generation N87-14270
Parameter estimation problems for distributed systems using a multigrid method
[NASA-CR-178194] N87-14862
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924
Multigrid solution of monotone second-order discretizations of hyperbolic conservation laws
[CWI-NM-R8611] N87-14955
COMPUTER AIDED DESIGN
A practical guide to the design of rhombic aerials
[RAE-TM-RAD-NAV-268] N87-14566
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
Methodology verification of hierarchically described VLSI circuits
[AD-A171742] N87-14605
Coordinate free LAP
[AD-A169982] N87-14877
Non-roman font generation via interactive computer graphics
[AD-A170614] N87-14880
Eindhoven Schematic Editor (ESCHER) reference manual — electric circuit design
[EUT-86-E-157] N87-14897

Evaluation of functions and interfaces for computer aided engineering in support of space systems design, management study
[ESA-CR(P)-2222] N87-14901
Microprocessor controlled optical measuring system for large mirror modules
[ESA-TT-984] N87-14995

COMPUTER AIDED MANUFACTURING
Evaluation of functions and interfaces for computer aided engineering in support of space systems design, management study
[ESA-CR(P)-2222] N87-14901

COMPUTER ASSISTED INSTRUCTION
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
Examination results in context MBA
[EUT-85-E-150] N87-14900

COMPUTER DESIGN
BACON-52 single board controller
[DIGEL-68] N87-14869

COMPUTER GRAPHICS
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
Applications of computer-graphics animation for motion-perception research
[NASA-TM-86335] N87-14845
Postexperimental plots with a HP 7550A plotter
[DE86-015501] N87-14866
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878
Non-roman font generation via interactive computer graphics
[AD-A170614] N87-14880
Enhanced simulation output through the use of spreadsheet software
[AD-A170671] N87-14881
Surface reconstruction from planar contours
[AD-A171617] N87-14884
UNIGRAPH: A program system for graphic output, documentation and management of arbitrary, two-dimensional volumes of data
[KFK-4061] N87-14888

COMPUTER INFORMATION SECURITY
A review of methods of personal identity verification — computer information security
[NPL-DITC-73/86] N87-15022

COMPUTER NETWORKS
Performance evaluation and control of distributed computer communication networks
[AD-A170810] N87-14579
Distributed control in computer networks and cross sections of colored multidimensional bodies
[CWI-CS-R8611] N87-14906
Systolic networks for the solution of linear problems
[ETN-87-98589] N87-14909

COMPUTER PROGRAM INTEGRITY
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878

COMPUTER PROGRAMMING
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878
The cleaning person algorithm — B programming language
[CWI-CS-R8610] N87-14889
Knowledge representation and inference in rule-based systems
[CWI-CS-R8613] N87-14891
PROLOG: An expert system building tool
[CWI-CS-R8616] N87-14893

COMPUTER PROGRAMS
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1
[DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual
[DOT/FAA/CT-86/25-2] N87-14307
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
User's introductory guide (HM-256)
[DE86-013002] N87-14886
UNIGRAPH: A program system for graphic output, documentation and management of arbitrary, two-dimensional volumes of data
[KFK-4061] N87-14888
NUMVEC FORTRAN library manual. Chapter: Simultaneous linear equations
[CWI-NM-R8614] N87-14896
Examination results in context MBA
[EUT-85-E-150] N87-14900
NUMVEC FORTRAN library manual. Chapter: Parabolic Partial Differential Equations (PDEs). Routine: Backward differentiation multigrid (BDMG)
[CWI-NM-R8610] N87-14927

COMPUTER STORAGE DEVICES
The power of the queue — computer storage models
[CWI-CS-R8612] N87-14890

COMPUTER SYSTEMS DESIGN
Assessment of data handling configuration for onboard operating system definition, phase 2/3
[MATRA-RF/139/1096] N87-14867
BACON-52 single board controller
[DIGEL-68] N87-14869
PROLOG: An expert system building tool
[CWI-CS-R8616] N87-14893
Evaluation of methods for coordination of software technological tasks using examples of the Spacelab program and air surveillance program. Part 3: Experience report for a software project for air surveillance
[BMFT-FB-DV-86-005] N87-14898

COMPUTER SYSTEMS PERFORMANCE
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908

COMPUTER SYSTEMS PROGRAMS
Orbit calculation for artificial Earth satellites
[GKSS-86/E/21] N87-14365

COMPUTER TECHNIQUES
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
Fault tolerance in parallel architectures
[AD-A170245] N87-14864
Queueing analysis of fault-tolerant computer systems
[AD-A170303] N87-14865

COMPUTERIZED SIMULATION
On a data base system for numerical simulator
N87-14252
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations
N87-14266
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-98436] N87-14287
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1
[DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual
[DOT/FAA/CT-86/25-2] N87-14307
Rendezvous and docking (RVD) guidance simulation program, rider 2
[MATRA-EPT/DT/VT068/012] N87-14359
A computer simulation of detonation within an energetic molecular crystal
[AD-A171662] N87-14472
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170829] N87-14577
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652
Numerical simulation of turbulent structures in a mixing zone
[ETN-87-98582] N87-14660
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14665
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
Applications of computer-graphics animation for motion-perception research
[NASA-TM-86335] N87-14845
MOS circuit models in network C
[AD-A169951] N87-14876
Coordinate free LAP
[AD-A169982] N87-14877
Enhanced simulation output through the use of spreadsheet software
[AD-A170671] N87-14881
Large signal modeling and analysis of the GaAs MESFET
[AD-A170304] N87-15011
Distributed charge model MOS transistors
[ENST-86D003] N87-15019
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131

COMPUTERS
A model of typing performance with respect to mental load factors — computer operators
[DRIC-T-7770] N87-14844
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

CONCENTRATION (COMPOSITION)
Mass spectrometric concentration measurements in supersonic flows with chemical reactions N87-14334
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798
Methods of remote evaluation of chlorophyll concentration in the sea
[DRIC-T-7652] N87-14824

CONCRETES
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554

CONCURRENT PROCESSING
User's introductory guide (HM-256)
[DE86-013002] N87-14886

CONDITIONING (LEARNING)
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830

CONDUCTION ELECTRONS
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999

CONFERENCES
First International Conference Materials in Aerospace
[BAE-S85/AMR/0080] N87-14243
Proceedings of the SMRM Degradation Study Workshop
[NASA-TM-89274] N87-14374
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods
[JUEL-CONF-55] N87-14450
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California
[AD-A170066] N87-14522
Two Phase Flows in Major Technological Hazards, volume 2 — conference
[VKI-LS-1986-03-VOL-2] N87-14544
Introduction to Vortex Dynamics, volume 1 — conference
[VKI-LS-1986-08-VOL-1] N87-14630
Introduction to Vortex Dynamics, volume 2 — conference
[VKI-LS-1986-VOL-2] N87-14637
Activities of the 1st International Laser Science Conference
[AD-A173080] N87-14699

ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

CONFORMAL MAPPING
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Geological-morphological description of the Ishtar Terra (photomap of the Venusian surface sheet B-5)
[NASA-TM-88497] N87-15143

CONGRESSIONAL REPORTS
Space shuttle accident
[S-HRG-99-967] N87-14369
Report of the National Commission on Space
[S-HRG-99-954] N87-15028

CONICAL BODIES
Development of supersonic computational aerodynamic program using panel method N87-14261
Numerical calculations of extrusion by conical molds
[ETN-87-98700] N87-14748

CONNECTORS
Dual battery connector arrangement
[AD-D012544] N87-14607

CONSERVATION LAWS
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
Multigrid solution of monotone second-order discretizations of hyperbolic conservation laws
[CWI-NM-R8611] N87-14955

CONSISTENCY
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936

CONSOLES
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330

CONSTRAINTS
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948

CONSTRUCTION
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356

CONTAMINANTS
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524

CONTAMINATION
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428

CONTINUITY (MATHEMATICS)
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924

CONTINUOUS RADIATION
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831

CONTOURS
Surface reconstruction from planar contours
[AD-A171617] N87-14884

CONTRAST
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14613

CONTROL BOARDS
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330

CONTROL EQUIPMENT
Dynamic Current Detector (DCD) — spacecraft power supplies
[SD/REPO/0001] N87-14610
Electrothermal gas generator: Development and qualification of the control electronics
[BMFT-FB-W-86-006] N87-14611

CONTROL STABILITY
Frozen orbits-near constant or beneficially varying orbital parameters
[AD-A170675] N87-14362
Robust stability under additive perturbations: An implicit assumption — control stability
[OUEL-1622/86] N87-14912
Reduced complexity set-point following in self-tuning control
[OUEL-1626/86] N87-14913

CONTROL SURFACES
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643

CONTROL SYSTEMS DESIGN
Reduced complexity set-point following in self-tuning control
[OUEL-1626/86] N87-14913

CONTROL THEORY
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693

CONTROL VALVES
Two-phase flow through safety devices and valves N87-14552

CONTROLLABILITY
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871

CONVECTIVE HEAT TRANSFER
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Analysis of conduction from a heated cubical element to a plane conducting wall, appendix A N87-14622
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652

CONVERGENCE
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-608-IMAG-M] N87-14949

CONVERGENT-DIVERGENT NOZZLES
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645

CONVEXITY
Stochastic convexity and its applications
[AD-A170112] N87-14939

COOLANTS
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652

COOLING
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629

COPLANARITY
Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet
[NASA-TM-88922] N87-14283

COPPER
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model
[AD-A169495] N87-14490

CORE FLOW
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350

CORONAGRAPHS
An atlas of photospheric magnetic field observations and computed coronal magnetic fields: 1976 - 1985
[NASA-CR-180019] N87-15151

CORONAL HOLES
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153

CORONAS
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study
[NASA-CR-177900] N87-15150
A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite
[AD-A170139] N87-15152

CORROSION
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511

CORROSION PREVENTION
High-temperature corrosion and methods of its control
[PB86-229663] N87-14484

CORROSION RESISTANCE
Recent progress in the field of cathodic protection
[DRIC-T-7857] N87-14485

COSMIC DUST
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049
Models of polarized infrared emission from bipolar nebulae N87-15050
Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
Grain processes in massive star formation N87-15063
Identification of polycyclic aromatic hydrocarbons N87-15096
Unusual relative strengths of the diffuse interstellar bands in some interstellar dust clouds N87-15105
Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109
Molecular catastrophes and the formation of circumstellar dust N87-15116
Organic grains in comets
[PREPRINT-122] N87-15137

COSMIC PLASMA
Double layers and circuits in astrophysics
[NASA-CR-180018] N87-15136

COSMOLOGY
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132
Cosmic superstrings and related topics
[DE86-702738] N87-15133
Superunification, phase transitions and cosmology
[DE86-702955] N87-15134

COST EFFECTIVENESS
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772
Advanced Stirling conversion systems for terrestrial applications
[NASA-TM-88897] N87-15031

COST ESTIMATES
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138

COST REDUCTION
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138

COUNTER-ROTATING WHEELS
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341

COUNTERMEASURES
Fade countermeasures for satellite communications
[ESA-STM-235] N87-14560

COUPLERS
Unique coupler evaluation techniques and results
[DE86-012101] N87-14982

COVERINGS
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778

CRACK GEOMETRY
A method and a device to determine the crack depth of surface cracks
[BLL-TRANS-AAEC-798-(1797.43)] N87-14728
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740

CRACK INITIATION
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948

CRACK PROPAGATION
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods [AD-A170327] N87-14319
A study of the fatigue behavior of short cracks in nickel-based superalloys [AD-A170199] N87-14492
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials [AD-A170218] N87-14493
Stable crack growth in aluminum tensile specimens [AD-A170299] N87-14494
A study of fatigue crack propagation in powder metallurgy hot isostatically pressed nickel-base alloy [AD-A173211] N87-14497
Theory of environmental effects on transgranular fracture [DE86-016165] N87-14502
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel [AERE-R-12138] N87-14512
Fault detection sensitivity in thick light alloy specimens, test report [REPT-47-084/F] N87-14721
Tearing of circumferential cracks in pipes loaded by bending [AD-A170429] N87-14734
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects [AD-A170644] N87-14736
Mixed mode 1 and 2 fully plastic crack growth [AD-A170645] N87-14737
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth [AD-A170648] N87-14738
In-situ TEM studies of crack tip deformation in molybdenum [DE86-013346] N87-14740
Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate [NLR-MP-85062-U] N87-14744
Ultrasonic fatigue studies of short and long surface cracks [FFA-TN-1986-44] N87-14746
Load interaction effects on fatigue crack propagation in steels of varying strength [FFA-TN-1986-47] N87-14747
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load [DFVLR-FB-86-30] N87-14751

CRACK TIPS
Tearing of circumferential cracks in pipes loaded by bending [AD-A170429] N87-14734
In-situ TEM studies of crack tip deformation in molybdenum [DE86-013346] N87-14740
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral [GKSS-86/E/15] N87-14752

CRACKS
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack [AD-A170135] N87-14732

CRASH LANDING
Human factors in accidents due to controlled flight into the ground [CAA-PAPER-85015] N87-14298

CRASHWORTHINESS
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1 [DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual [DOT/FAA/CT-86/25-2] N87-14307

CREEP ANALYSIS
The modelling of creep for engineering design-1 — metals, ceramics [NPL-DMA-A115] N87-14727

CREEP PROPERTIES
The modelling of creep for engineering design-1 — metals, ceramics [NPL-DMA-A115] N87-14727

CREEP RUPTURE STRENGTH
Stress rupture of carbon fiber composite materials [DE86-012854] N87-14443

CREEP STRENGTH
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels [BLL-CE-TRANS-8252-(9022.09)] N87-14481

CRITICAL MASS
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
Jeans criterion in a turbulent medium N87-15065

CROSS CORRELATION
Optical Gaussian convolvers [AD-D012436] N87-14976

CROSS FLOW
Turbulence modeling for steady three-dimensional supersonic flows [AD-A170042] N87-14285
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles [AD-A169531] N87-14647
Experimental investigations on the stability and transition of three-dimensional boundary layers [DFVLR-FB-86-24] N87-14664

CRYOGENIC ROCKET PROPELLANTS
An overview of the British Aerospace HOTOL transatmospheric vehicle [NASA-TM-88008] N87-14317

CRYOPUMPING
Fluid dynamic problems in the HM60 (Vulcain) cryogenic turbopump — Ariane 5 N87-14399
Aerodynamic design and test of a supersonic turbine for a rocket engine — Ariane 5 N87-14400

CRYSTAL DEFECTS
Growth of cadmium telluride under controlled heat transfer conditions [AD-A170031] N87-15008
Polarizability of a crystal with impurities [DE86-702900] N87-15014

CRYSTAL GROWTH
Research activities of the National Institute for Materials Research, 1985 [DE86-702785] N87-14436
Growth of a silicon single crystal by the floating-zone technique under micro-g conditions during Spacelab 1 [BMFT-FB-W-86-004] N87-14542
Preparation of a solvent zone crystallization experiment of cadmium telluride during the First SpaceLab Project (FSLP) Spacelab mission [BMFT-FB-W-86-005] N87-14543
Liquid encapsulated float zone process and apparatus [NASA-CASE-MFS-28144-1] N87-15004

CRYSTAL LATTICES
A computer simulation of detonation within an energetic molecular crystal [AD-A171662] N87-14472
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model [AD-A169495] N87-14490
Novel Si-based materials and device structures by molecular beam epitaxy [AD-A170061] N87-15009
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques [AERE-R-11909] N87-15021

CRYSTAL STRUCTURE
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys [AD-A170136] N87-14491
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4) [AD-A168886] N87-14519
Surface chemistry of ceramic thin film and powder surfaces [DE86-012657] N87-14529
Polymers in mechanochemical systems: Structure-property requirements [DE86-014308] N87-14530
Growth of cadmium telluride under controlled heat transfer conditions [AD-A170031] N87-15008

CRYSTALS
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California [AD-A170066] N87-14522
Stark ladder density of states in a finite crystal [DE86-702906] N87-15015

CURRENT DENSITY
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources [DE86-016010] N87-14967

CURRENT SHEETS
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event [REPT-7-86] N87-14791

CURVATURE
Curved silicon substrates for multilayer structures [DE86-013305] N87-14963

CUTTERS
In situ repair of a failed compression fitting [DE86-013682] N87-14707

CYANIDES
HC3N maps of OMC1 N87-15056

CYCLES
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests [NASA-TM-88821] N87-14487
Performance of a pipeline array of automata with periodic cycle-time [RR-607-IMAG-I] N87-14908

CYCLIC HYDROCARBONS
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120

CYCLIC LOADS
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate [NASA-TM-88841] N87-14489
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport [DOT/FAA/PM-84/16,4] N87-14554

CYCLOTRON RESONANCE
Soviet development of gyrotrons [AD-A169680] N87-14690

CYCLOTRON RESONANCE DEVICES
Soviet development of gyrotrons [AD-A169680] N87-14690

CYLINDRICAL BODIES
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion [CETIM-12-B-162] N87-14445
Study of phenomena of unsteady boundary-layer separation [AD-A170428] N87-14649
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing [DE86-013681] N87-14719

CYLINDRICAL PLASMAS
Experimental evidence of MHD surface wave [ISSN-0469-4732] N87-14997

CYLINDRICAL SHELLS
Tearing of circumferential cracks in pipes loaded by bending [AD-A170429] N87-14734

CZOCHRALSKI METHOD
Growth of cadmium telluride under controlled heat transfer conditions [AD-A170031] N87-15008

D

DAMAGE
Nondestructive tests of Carbon Fiber Reinforced Plastics (CFRP) in the framework of damage mechanics investigations N87-14438
Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Acoustic emission analysis of Carbon Fiber Reinforced Plastics (CFRP) N87-14440
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range [DE86-014942] N87-14786

DAMAGE ASSESSMENT
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods [AD-A170327] N87-14319

DATA ACQUISITION
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
A low-cost optical data acquisition system for vibration measurement [NASA-TM-88907] N87-14730
More interstellar emission features at 3.3-3.6 micrometers! N87-15100
Phobos and Deimos: Satellites of Mars [NASA-TM-88016] N87-15142

DATA BASE MANAGEMENT SYSTEMS
On a data base system for numerical simulator N87-14252
Database oriented UNIX operating environment and its application N87-14253
Archive data base and handling system for the Orbiter flying qualities experiment program [NASA-CR-166622] N87-14351

UNIGRAPH: A program system for graphic output, documentation and management of arbitrary, two-dimensional volumes of data
[KFK-4081] N87-14838
A general object-centered database language (GODEL): A preliminary definition
[CWI-CS-R8615] N87-14892

DATA BASES
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
A general object-centered database language (GODEL): A preliminary definition
[CWI-CS-R8615] N87-14892
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915

DATA COMPRESSION
CADISS: An onboard system for compression and decompression of imagery sensor signals
[NLR-MP-85045-U] N87-14868

DATA LINKS
Adaptive TDMA as a means of trading power against bandwidth — satellite transmission N87-14563

DATA MANAGEMENT
The data circulation mission in the Meteosat 2000 program
[ESA-CR(P)-2221] N87-14817

DATA PROCESSING
Archive data base and handling system for the Orbiter flying qualities experiment program
[NASA-CR-166622] N87-14351
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838
Real-time garbage collection for list processing
[NASA-CASE-MSC-20964-1] N87-14863
MORE operating system: A message oriented resource environment
[DE86-013932] N87-14867
Examination results in context MBA
[EUT-85-E-150] N87-14900

DATA PROCESSING EQUIPMENT
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577

DATA REDUCTION
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648

DATA SAMPLING
Design of filters for the vertical subsampling of color difference signals at half the sampling rate — color television
[FI-447-TB-19] N87-14587
Model reduction of sampled data systems
[OUEL-1625/86] N87-14930

DATA STRUCTURES
Real-time garbage collection for list processing
[NASA-CASE-MSC-20964-1] N87-14863

DECISION MAKING
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580

DECISION THEORY
Program synthesis = proof method + knowledge. Example of recursion function synthesis
[RR-605-IMAG-48-LIFIA-I] N87-14903

DECOMPOSITION
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457

DEFECTS
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing
[DE86-013681] N87-14719
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756

DEFENSE PROGRAM
DOD (Department of Defense) acquisition: Case study of the Navy V-22 OSPREY Joint Vertical Lift Aircraft Program
[PB86-231388] N87-14315
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230820] N87-15023

DEFORMATION
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740
Structural ensembles of the north belt of Venus deformations and possible mechanisms of their formation
[NASA-TM-88511] N87-15141

DEGRADATION
Degradation studies of SMRM Teflon N87-14392
Determination of the technical degradation of nitrogen oxides in the atmosphere
[BPT-3/86] N87-14785

DEGREES OF FREEDOM
Relaxation of vibrational degrees of freedom N87-14335
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712

DEIMOS
Phobos and Deimos: Satellites of Mars
[NASA-TM-88016] N87-15142

DELAY LINES
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654

DELTA WINGS
Compressibility effects on delta wing flow fields N87-14641

DEMOGRAPHY
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857

DENSITY (MASS/VOLUME)
Size-density relations in dark clouds: Non-LTE effects N87-15068

DENSITY (NUMBER/VOLUME)
Polarizability of a crystal with impurities
[DE86-702900] N87-15014

DENSITY DISTRIBUTION
Interferometry — of spatial flows N87-14332
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14666

DEPOLARIZATION
Non-aqueous primary cell
[AD-D012428] N87-14599

DEPOSITION
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14788
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003

DESCENT
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915

DESIGN ANALYSIS
Development of the highly loaded axial flow turbine airfoils, making use of the improved inverse channel flow design method N87-14257
Application of the e sup N method to calculations of laminar flow control N87-14263
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Design of Programmable Logic Arrays (PLA) CMOS
[ETN-87-98590] N87-14617
Contribution to the study of a monolithic 32 bit processor in CMOS technology
[ETN-87-98592] N87-14618
Design, analysis and test verification of advanced encapsulated systems
[NASA-CR-177078] N87-14619
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703
Developments in blade shape design for a Darrieus vertical axis wind turbine
[DE86-010056] N87-14774
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871
Brayton cycle solarized advanced gas turbine
[NASA-CR-179559] N87-15030

DESTRUCTIVE TESTS
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441

DETECTION
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing
[DE86-013681] N87-14719
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973

DETONABLE GAS MIXTURES
Combustion process of hydrogen-air mixtures under technical conditions N87-14338

DETONATION WAVES
A computer simulation of detonation within an energetic molecular crystal
[AD-A171682] N87-14472

DIAGNOSIS
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170630] N87-15025

DIATOMIC MOLECULES
A computer simulation of detonation within an energetic molecular crystal
[AD-A171682] N87-14472

DIELECTRIC PROPERTIES
Renormalization of an inverse scattering theory for Gaussian dielectric profiles
[AD-A169328] N87-14571

DIELECTRICS
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

DIESEL ENGINES
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708

DIFFERENTIAL EQUATIONS
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Deformations of connections, the Riemann Hilbert problem and tau functions
[CWI-PM-M8802] N87-14953

DIFFRACTION
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756

DIFFUSION
High temperature properties and processes in ceramics: Thermomigration
[DE86-015035] N87-14531
A simulation feasibility study
[AD-A169651] N87-14793

DIFFUSION COEFFICIENT
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495
Transport of toxic material in aerosol phase N87-14547

DIGITAL SIMULATION
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
Numerical modeling of aerosols N87-14548
Numerical simulation of vortical flow N87-14640
Construction of a digital height model based on simple finite elements — photogrammetry
[SER-C-315] N87-14783
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

DIGITAL TECHNIQUES
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
On hierarchical edge matching in digital images using distance transformations
[FOA-B-30094-E1] N87-14902

DIGITAL TO ANALOG CONVERTERS
A computer interface for digital control of a dc power source, appendix E N87-14626

DIMENSIONAL MEASUREMENT
Anthropometry handbook
[AD-A170295] N87-14855

DIRECT CURRENT
Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456
A stabilized dc plasma and an advanced spectrochemical analysis system N87-14458
Verification and modification of the dc MOS-transitor model of Poorter
[E-EEA/323/10/1984] N87-15020
DIRECTORIES
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
DIRICHLET PROBLEM
Interaction of diffusion and boundary conditions
[AD-A170217] N87-14922
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934
DISCRETE FUNCTIONS
Preliminary consideration on robustness of nonlinear discrete-time regulators
[INPE-4015-RPE/520] N87-14917
DISKS (SHAPES)
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049
DISLOCATIONS (MATERIALS)
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740
DISPERSING
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829
The velocity dispersion of the giant molecule clouds: A viscous origin N87-15091
DISPERSIONS
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407
Swept frequency technique for dispersion measurement of microstrip lines
[NASA-TM-88836] N87-14597
DISPLACEMENT
Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral
[GKSS-86/E/15] N87-14752
DISPLAY DEVICES
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330
Enhanced simulation output through the use of spreadsheet software
[AD-A170671] N87-14881
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980
Liquid crystal materials and electrooptic effects for high information content displays
[BMFT-FB-T-86-018] N87-14988
DISTANCE
On hierarchical edge matching in digital images using distance transformations
[FOA-B-30094-E1] N87-14902
Neutral hydrogen cloud distances and the strength of the interstellar magnetic field N87-15086
DISTORTION
Is OH abundance enhanced in tidally distorted galaxies? N87-15094
DISTRIBUTED PARAMETER SYSTEMS
Parameter estimation problems for distributed systems using a multigrid method
[NASA-CR-178194] N87-14862
Distributed charge model MOS transistors
[ENST-86D003] N87-15019
DISTRIBUTED PROCESSING
Portable operating systems for network computers: Distributed operating systems support for group communications
[AD-A170113] N87-14905
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170830] N87-15025
DISTRIBUTION FUNCTIONS
Stochastic convexity and its applications
[AD-A170112] N87-14939
DIVING (UNDERWATER)
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
DO-28 AIRCRAFT
The icing research aircraft Do28, D-IFMP of DFVLR and its measuring equipment
[ESA-TT-972] N87-14326
DOCUMENTATION
UNIGRAPH: A program system for graphic output, documentation and management of arbitrary, two-dimensional volumes of data
[KFK-4061] N87-14888
DOORS
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-528] N87-14304
DOPPLER EFFECT
Vibration-free Raman Doppler velocimeter
[NASA-CASE-LAR-13268-1] N87-14669
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698
DOPPLER RADAR
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814
DOSIMETERS
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157
DOUBLE BASE PROPELLANTS
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
DROP SIZE
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
DROPS (LIQUIDS)
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698
DUAL THRUST NOZZLES
Extendable nozzle for the HM60 rocket engine — Ariane 5 N87-14398
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424
DUCTILITY
Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512
Micromechanics 2
[AD-A170560] N87-14735
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects
[AD-A170644] N87-14736
Mixed mode 1 and 2 fully plastic crack growth
[AD-A170645] N87-14737
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948
DUCTS
A finite element method for high Reynolds number flow N87-14259
DUMMIES
Anthropometry handbook
[AD-A170298] N87-14855
DUST
Depletions and extinction curves for lines of sight through the outer edges of truly dense molecular clouds N87-15110
The shapes of the circumstellar silicate features N87-15111
Spectral characteristics of dust in carbon rich objects N87-15113
DYE LASERS
Resonator internal absorption N87-14685
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691
A precision laser spectrometer system
[AD-A170226] N87-14692
DYNAMIC CHARACTERISTICS
Resonator internal absorption and nonlinear dynamics of multimode laser systems
[MPE-197] N87-14684
Dynamics of multimode lasers N87-14686
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712
Frequency response functions of a nonlinear system
[DE86-016103] N87-14742
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814
DYNAMIC CONTROL
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
DYNAMIC LOADS
Analysis of shock and vibration environments for cargo on C9B transport aircraft
[DE86-016101] N87-14322
DYNAMIC RESPONSE
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Experimental investigations of dynamic effects in impact tests
[W-1/85] N87-14749
DYNAMIC STABILITY
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753
Stability of a shear model in which perturbations move with the mean local flow
[PB86-232469] N87-14805
Local interstellar gasdynamical stability in spiral arm flow N87-15092
DYNAMIC STRUCTURAL ANALYSIS
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743
DYNAMIC TESTS
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731
DYNAMICAL SYSTEMS
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
DYSPNEA
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840

E

EARLY STARS
Spectral evolution of young stellar objects N87-15066
EARTH (PLANET)
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14996
EARTH ATMOSPHERE
On 10-60 GHz G/T measurements using the Sun as a source: A preliminary study
[PB86-230034] N87-14595
EARTH CRUST
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794
EARTH OBSERVATIONS (FROM SPACE)
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798
EARTH OBSERVING SYSTEM (EOS)
The Geoscience Laser Altimetry/Ranging System (GLARS)
[NASA-TM-87803] N87-14687
EARTH ORBITS
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
Frozen orbits-near constant or beneficially varying orbital parameters
[AD-A170675] N87-14362
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
EARTH PLANETARY STRUCTURE
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794

EARTH ROTATION
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
EARTH TERMINAL MEASUREMENT SYSTEM
On 10-60 GHz G/T measurements using the Sun as a source: A preliminary study
[PB86-230034] N87-14595
EARTH-MOON SYSTEM
Models for the prediction of polar coordinates of lunar reflectors in the dynamic Earth-Moon system
[REPT-69] N87-14701
EARTHQUAKES
Redetermination of earthquake body-wave magnitudes (m sub b) using ISC bulletin data — International Seismological Center (ISC)
[AWRE-O-21/85] N87-14790
ECLIPSES
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115
ECONOMIC ANALYSIS
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
ECOSYSTEMS
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
EDDY CURRENTS
Fault detection sensitivity in thick light alloy specimens, test report
[REPT-47-084/F] N87-14721
Eddy current automation. Discrimination and selection software applied to hardness control
[CETIM-100-090] N87-14722
EDDY VISCOSITY
Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
EDGES
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
On hierarchical edge matching in digital images using distance transformations
[FOA-B-30094-E1] N87-14902
EDITING
Non-roman font generation via interactive computer graphics
[AD-A170614] N87-14880
EDUCATION
Computational fluid dynamics in engineering and education
[CFDU/86/6] N87-14658
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
Examination results in context MBA
[EUT-85-E-150] N87-14900
Compendium of research
[AD-A170356] N87-15024
EFFERENT NERVOUS SYSTEMS
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
EGYPT
Analyses of the phosphate standard of the Egyptian Nuclear Materials Corporation (phosphate 1) N87-14459
ELASTIC DEFORMATION
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733
ELASTIC PROPERTIES
Nonlinear wave propagation study
[AD-A170201] N87-14572
ELASTIC WAVES
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756
ELASTODYNAMICS
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753
ELASTOPLASTICITY
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753
ELECTRIC ARCS
Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456
ELECTRIC CHARGE
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
ELECTRIC CONDUCTORS
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578
ELECTRIC CONNECTORS
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171676] N87-14604
Electrical receptacle
[AD-D012528] N87-14606 *
ELECTRIC CONTACTS
Quantum well electron barrier diode
[AD-D012432] N87-14600
ELECTRIC CONTROL
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[ESA-TT-979] N87-14352
ELECTRIC CORONA
Asymptotic analysis of corona discharge from thin electrodes
[NASA-TP-2645] N87-14998
ELECTRIC CURRENT
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14996
ELECTRIC DISCHARGES
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
Asymptotic analysis of corona discharge from thin electrodes
[NASA-TP-2645] N87-14998
ELECTRIC FIELDS
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
Stark ladder density of states in a finite crystal
[DE86-702906] N87-15015
ELECTRIC FUSES
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
ELECTRIC HYBRID VEHICLES
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
ELECTRIC NETWORKS
Improved signal delay bounds for RC tree networks
[AD-A169625] N87-14874
ELECTRIC OUTLETS
Electrical receptacle
[AD-D012528] N87-14606
ELECTRIC PROPULSION
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
Electric propulsion options for the SP-100 reference mission
[NASA-TM-88918] N87-14422
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
ELECTRIC PULSES
Pulse shaping with transmission lines
[DE86-013674] N87-14608
ELECTRICAL ENGINEERING
A practical guide to the design of rhombic aerials
[RAE-TM-RAD-NAV-266] N87-14566
High bandwidth analog applications of photonics: Present capabilities and future possibilities
[DE86-014999] N87-14582
ELECTRICAL MEASUREMENT
Dynamic Current Detector (DCD) — spacecraft power supplies
[SD/REPO/0001] N87-14610
ELECTRICAL PROPERTIES
Survey of materials and device technologies for high-temperature (T300C) power semiconductor electronics
[DE86-015822] N87-15017
ELECTRICAL RESISTANCE
Dynamic Current Detector (DCD) — spacecraft power supplies
[SD/REPO/0001] N87-14610
ELECTRICAL RESISTIVITY
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
ELECTRO-OPTICAL EFFECT
Liquid crystal materials and electrooptic effects for high information content displays
[BMFT-FB-T-86-018] N87-14088
ELECTRO-OPTICS
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
ELECTROCARDIOGRAPHY
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832
ELECTROCATALYSTS
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468
ELECTROCHEMICAL CELLS
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
ELECTROCHEMICAL OXIDATION
Electrochemical behavior of a titanium electrode in hydrazine solutions
[NASA-TM-88538] N87-14464
ELECTROCHEMISTRY
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
Non-aqueous primary cell
[AD-D012428] N87-14599
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
ELECTRODEPOSITION
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model
[AD-A169495] N87-14490
ELECTRODES
Electrochemical behavior of a titanium electrode in hydrazine solutions
[NASA-TM-88538] N87-14464
Design of thin-gap channel flow cells
[DE86-016159] N87-14609
Asymptotic analysis of corona discharge from thin electrodes
[NASA-TP-2645] N87-14998
ELECTRODYNAMICS
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
ELECTROENCEPHALOGRAPHY
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
ELECTROLYSIS
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
ELECTROLYTES
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537
Design of thin-gap channel flow cells
[DE86-016159] N87-14609

ELECTROLYTIC CELLS
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468
Nicad battery packages
[AD-A170140] N87-14598
Non-aqueous primary cell
[AD-D012428] N87-14599
ELECTROMAGNETIC ABSORPTION
Resonator internal absorption and nonlinear dynamics of multimode laser systems
[MPE-197] N87-14684
Resonator internal absorption N87-14685
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170621] N87-14979
ELECTROMAGNETIC COMPATIBILITY
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170689] N87-14312
ELECTROMAGNETIC FIELDS
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830
ELECTROMAGNETIC INTERFERENCE
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993
ELECTROMAGNETIC PROPULSION
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
ELECTROMAGNETIC PULSES
Pulse shaping with transmission lines
[DE86-013674] N87-14608
Laser physics and laser techniques
[AD-A171949] N87-14697
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
ELECTROMAGNETIC RADIATION
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
ELECTROMAGNETIC SCATTERING
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170689] N87-14312
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578
ELECTROMAGNETIC WAVE TRANSMISSION
Finite element modeling of electromagnetic propagation in composite structures
[NASA-TM-88916] N87-14956
ELECTROMIGRATION
Report on an interlaboratory electromigration experiment
[AD-A169652] N87-15006
ELECTROMOTIVE FORCES
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485
ELECTRON BEAMS
Pulse amplifier with high common-mode rejection
[DIGEL-70] N87-14615
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
ELECTRON DIFFRACTION
Research activities of the National Institute for Materials Research, 1985
[DE86-702765] N87-14436
ELECTRON ENERGY
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795
Planetary nebulae and the interstellar medium N87-15076
ELECTRON MICROSCOPES
A noise reduction system for video signals with a low signal to noise ratio
[ETN-86-98720] N87-14614
ELECTRON MICROSCOPY
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740
ELECTRON PUMPING
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
Methods of plasma excitation
[AD-A170347] N87-15002
ELECTRON SCATTERING
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963
ELECTRON SPECTROSCOPY
Special techniques for the Auger analysis of microelectronic devices
[AD-A171631] N87-14603
Spectroscopy of the phonons on noble gas surfaces using helium atomic beam scattering
[MPIS-1/1986] N87-14968
ELECTRONIC CONTROL
Soviet development of gyrotrons
[AD-A169680] N87-14690
Universal microcomputer for the control of electronic equipment
[GSI-86-12] N87-14870
ELECTRONIC EQUIPMENT
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629
Universal microcomputer for the control of electronic equipment
[GSI-86-12] N87-14870
ELECTROSTATIC PROPULSION
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
ELECTROTHERMAL ENGINES
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
ELLIPSOIDS
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146
ELLIPTIC DIFFERENTIAL EQUATIONS
Solution of elliptic partial differential equations by fast Poisson solvers using a local relaxation factor. 2: Two-step method
[NASA-TP-2530] N87-14918
ELLIPTIC FUNCTIONS
Solution of elliptic partial differential equations by fast Poisson solvers using a local relaxation factor. 2: Two-step method
[NASA-TP-2530] N87-14918
ELLIPTICAL CYLINDERS
Propagation of sound waves in tubes of noncircular cross section
[NASA-TP-2601] N87-14284
EMBRITTLEMENT
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948
EMERGENCIES
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-528] N87-14304
EMISSION SPECTRA
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
The molecular content of the nearby galaxy from IRAS and HI observations N87-15087
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
Molecular hydrogen in the young starburst in NGC 253 N87-15096
Identification of polycyclic aromatic hydrocarbons N87-15098
More interstellar emission features at 3.3-3.6 micrometers! N87-15100
Resolution of the 7.7 micrometers emission feature in NGC 7027 N87-15101
Spectroscopy and CCD-photography of extended red emission in reflection nebulae N87-15102
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103
Infrared studies of supernova remnants with the IRAS N87-15104
Spectral characteristics of dust in carbon rich objects N87-15113
EMISSIVITY
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
EMITTANCE
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967
EMPLOYEE RELATIONS
Compendium of research
[AD-A170356] N87-15024
ENCAPSULATING
Liquid encapsulated float zone process and apparatus
[NASA-CASE-MFS-28144-1] N87-15004
END EFFECTORS
Passively activated prehensile digit for a robotic end effector
[NASA-CASE-NPO-16766-1-CU] N87-14705
ENDOTHERMIC REACTIONS
A computer simulation of detonation within an energetic molecular crystal
[AD-A171662] N87-14472
ENERGY ABSORPTION
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14648
ENERGY CONSERVATION
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772
ENERGY CONVERSION EFFICIENCY
Investigation of the optical properties of solar cells
[BMFT-FB-T-86-008] N87-14989
Brayton cycle solarized advanced gas turbine
[NASA-CR-179559] N87-15030
ENERGY DISSIPATION
Development of the highly loaded axial flow turbine airfoils, making use of the improved inverse channel flow design method N87-14257
ENERGY DISTRIBUTION
The shapes of the circumstellar silicate features N87-15111
ENERGY GAPS (SOLID STATE)
Quantum well electron barrier diode
[AD-D012432] N87-14600
ENERGY LEVELS
Quantum well electron barrier diode
[AD-D012432] N87-14600
Stark ladder density of states in a finite crystal
[DE86-702906] N87-15015
ENERGY POLICY
Applied system analysis no. 45: SOLARYS, an interactive model for the simulation of solar systems, parts 1 and 2 — solar energy
[JUEL-SPEZ-346-PT-1-PT-2] N87-14775
German-Korean cooperation for erection and test of industrialized solar technologies
[BMFT-FB-T-86-006] N87-14777
ENERGY STORAGE
Nicad battery packages
[AD-A170140] N87-14598
ENERGY TECHNOLOGY
Space technology in Berlin. Volume 1: ideas for the establishment of an institute for space processing technology
[NASA-TM-87994] N87-14541
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
ENERGY TRANSFER
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170838] N87-14651
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14996

ENGINE CONTROL
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708
ENGINE DESIGN
Fluid dynamic problems in the HM60 (Vulcain) cryogenic turbopump — Ariane 5 N87-14399
Aerodynamic design and test of a supersonic turbine for a rocket engine — Ariane 5 N87-14400
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424
ENGINE PARTS
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
ENGINES
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524
ENVIRONMENT EFFECTS
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
EPIDEMIOLOGY
Some evidence on non-transmissibility of acute upper respiratory disease and related matters
[PREPRINT-115] N87-14842
EPOXY MATRIX COMPOSITES
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300) N87-14444
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
EPOXY RESINS
Physical-chemical characterization of the 2220-3 resin in the AS4/2220-3 preimpregnated material, test report, part 1 — carbon-epoxy composite materials
[REPT-M4-475000-PT-1] N87-14533
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623
EQUATIONS OF MOTION
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
A monograph on Kepler's equation
[RAE-TR-85080] N87-14951
Constrained normalization of Hamiltonian systems and perturbed Keplerian motion
[CWI-PM-R8603] N87-14954
EQUIVALENT CIRCUITS
Large signal modeling and analysis of the GaAs MESFET
[AD-A170304] N87-15011
EROSION
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003
ERROR ANALYSIS
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591
Phase lag analysis of implicit Runge-Kutta methods
[CWI-NM-R8612] N87-14928
ERRORS
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936
ERS-1 (ESA SATELLITE)
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary
[ESA-CR(P)-2215] N87-14769
ESA SATELLITES
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770
ESCAPE SYSTEMS
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-528] N87-14304
ESCHERICHIA
The relation of bacterial absorptivity in the 3 to 4 micron waveband to observations of GC-IRS7 and sundry comments — infrared spectra
[PREPRINT-108] N87-15037
ESTIMATES
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973
ESTIMATING
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate
[NASA-TM-88841] N87-14489
ETCHING
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
ETHYL COMPOUNDS
The 5-(4-Ethynylophenoxy) isophthalic chloride
[NASA-CASE-LAR-13316-2] N87-14515
EULER EQUATIONS OF MOTION
Implicit time-marching methods for the transonic Euler equations N87-14254
An easily vectorizable numerical solution of the Euler equations N87-14258
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277
Three-dimensional Euler flow simulation on a Cyber 205 vector computer
[NLR-TR-85054-U] N87-14656
EURECA (ESA)
Space research in Belgium
[ISSN-0772-9804] N87-15159
EUROPE
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589
EUROPEAN SPACE PROGRAMS
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860
Space research in Belgium
[ISSN-0772-9804] N87-15159
EVAPORATION
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
EVOLUTION (DEVELOPMENT)
Filamentary structure in the Orion molecular cloud N87-15058
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
Supershells and propagating star formation N87-15067
Chemical evolution in spiral and irregular galaxies N87-15097
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132
EXAMINATION
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594
EXCIMER LASERS
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
EXCITATION
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
Methods of plasma excitation
[AD-A170347] N87-15002
EXERCISE PHYSIOLOGY
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835
EXHAUST GASES
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708
EXOBIOLOGY
The relation of bacterial absorptivity in the 3 to 4 micron waveband to observations of GC-IRS7 and sundry comments — infrared spectra
[PREPRINT-108] N87-15037
EXOSPHERE
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
EXOTHERMIC REACTIONS
A computer simulation of detonation within an energetic molecular crystal
[AD-A171662] N87-14472
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
EXPANDABLE STRUCTURES
Development of the 15 meter diameter hoop column antenna
[NASA-CR-4038] N87-14366
EXPERT SYSTEMS
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
Knowledge representation and inference in rule-based systems
[CWI-CS-R8613] N87-14891
PROLOG: An expert system building tool
[CWI-CS-R8616] N87-14893
EXPLOSIONS
Two Phase Flows in Major Technological Hazards, volume 2 — conference
[VKI-LS-1986-03-VOL-2] N87-14544
Steam explosions and associated hazards N87-14550
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786
The bird: A pressure-confined explosion in the interstellar medium N87-15062
EXPONENTIAL FUNCTIONS
On the relation between several statistics for testing for exponentiality and uniformity
[AD-A170259] N87-14945
EXPOSURE
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835
EXTERNAL STORE SEPARATION
Remote pivot decoupler pylon: Wing/store flutter suppressor
[NASA-CASE-LAR-13173-1] N87-14314
EXTINCTION
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978
EXTRATERRESTRIAL LIFE
Organic grains in comets
[PREPRINT-122] N87-15137
EXTREME ULTRAVIOLET RADIATION
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042
EXTREMUM VALUES
World weather extremes: Revision
[AD-A170138] N87-14810
EXTRUDING
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445
Numerical calculations of extrusion by conical molds
[ETN-87-98700] N87-14748

F

F-15 AIRCRAFT
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
FABRICATION
Method of fabricating an imaging X-ray spectrometer
[NASA-CASE-GSC-12956-1] N87-14871
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672

Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy [INPE-3992-PRE/992] N87-15005
Brayton cycle solarized advanced gas turbine [NASA-CR-179559] N87-15030

FABRICS
Effect of the raw material composition of fabrics on the Limiting Oxygen Index (LOI) [NASA-TM-88483] N87-14463

FABRY-PEROT INTERFEROMETERS
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity [ESA-TT-980] N87-14994

FACTOR ANALYSIS
Laboratory spectrometer for wear metal analysis of engine lubricants [AD-A170338] N87-14524

FAILURE
On the first failure time of dependent multicomponent reliability systems [AD-A170223] N87-14718

FAILURE ANALYSIS
Proceedings of the SMRM Degradation Study Workshop [NASA-TM-89274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
The Main Electronics Box (MEB) of the HAO coronagraph/polarimeter N87-14376
Radiation effects on selected electronics parts from the solar max satellite N87-14377
Failure analysis and performance evaluation of NASA inertial reference unit (DRIRU 2) after 50 months of orbital operation N87-14378
Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382
Results of examination of materials from the solar maximum recovery mission N87-14383
A report summary of activities and results related to adhesive bonding [AD-A173208] N87-14528

FAILURE MODES
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982 [NASA-TM-88007] N87-14305

FAR FIELDS
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers [AD-A170669] N87-14312

FAR INFRARED RADIATION
Far-infrared investigation of the Taurus star-forming region using the IRAS database N87-15044

FAR ULTRAVIOLET RADIATION
Depletions and extinction curves for lines of sight through the outer edges of truly dense molecular clouds N87-15110

FARADAY EFFECT
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers [REPT-4-86] N87-14996

FASTING
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance [AD-A169597] N87-14836

FATIGUE (MATERIALS)
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys [AD-A170136] N87-14491
A study of the fatigue behavior of short cracks in nickel-based superalloys [AD-A170199] N87-14492
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials [AD-A170218] N87-14493
A study of fatigue crack propagation in powder metallurgy hot isotatically pressed nickel-base alloy [AD-A173211] N87-14497

FATIGUE LIFE
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods [AD-A170327] N87-14319
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate [NASA-TM-88841] N87-14489

FATIGUE TESTS
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft [AD-A170902] N87-14357
Stress rupture of carbon fiber composite materials [DE86-012854] N87-14443
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report [REPT-M1-538300] N87-14444
The cyclic stress-strain behavior of PWA 1480 at 650 deg C [NASA-TM-87311] N87-14483

FAULT TOLERANCE
Fault tolerance in parallel architectures [AD-A170245] N87-14864
Queueing analysis of fault-tolerant computer systems [AD-A170303] N87-14865

FEASIBILITY ANALYSIS
A simulation feasibility study [AD-A169651] N87-14793

FERRITIC STAINLESS STEELS
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels [BLL-CE-TRANS-8252-(9022.09)] N87-14481

FERROUS METALS
Analysis of ferrous materials — mass spectrometry N87-14451

FIBER COMPOSITES
Stress rupture of carbon fiber composite materials [DE86-012854] N87-14443

FIBER OPTICS
High bandwidth analog applications of photonics: Present capabilities and future possibilities [DE86-014999] N87-14582
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing [DE86-013681] N87-14719
Studies of phase-conjugate optical device concepts [AD-A170203] N87-14974
Unique coupler evaluation techniques and results [DE86-012101] N87-14982
Wavelength-multiplexed imaging techniques using optical fibers [DE86-013028] N87-14986
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity [ESA-TT-980] N87-14994

FIBER REINFORCED COMPOSITES
An assessment of aircraft repair schemes for battle damage and permanent usage [R946/8] N87-14246
Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures — aircraft structures [DFVLR-MITT-86-09] N87-14437
Fiber reinforced ceramic material [NASA-CASE-LEW-14392-1] N87-14517

FIBERS
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California [AD-A170066] N87-14522
The interfacial and compressive properties of polybenzothiazole fibers [AD-A171620] N87-14527

FIELD EFFECT TRANSISTORS
Large signal modeling and analysis of the GaAs MESFET [AD-A170304] N87-15011

FIELD EMISSION
Field emission electric propulsion. Industrial development of emitters modules, phase 1B [TS/SL/194/DV/30.094/82] N87-14429

FIELD STRENGTH
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126
Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127
Models for application of radiation boundary condition for MHD waves in collapse calculations N87-15128

FINITE DIFFERENCE THEORY
Numerical simulation of an aircraft icing N87-14248
Implicit time-marching methods for the transonic Euler equations N87-14254
An easily vectorizable numerical solution of the Euler equations N87-14258
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
A verification of unsteady Navier-Stokes solutions around oscillating airfoils [NASA-TM-88341] N87-14279
Numerical simulation of vortical flow N87-14640
Wall pressure fluctuations and acoustics in turbulent pipe flow [AD-A173359] N87-14655
Computational aspects of the ARA three invariant constitutive model [AD-A170072] N87-14879
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms [NASA-TM-89415] N87-14916

FINITE ELEMENT METHOD
Compressible flow analysis in turbomachinery N87-14256
A finite element method for high Reynolds number flow N87-14259
Design, analysis and test verification of advanced encapsulated systems [NASA-CR-177076] N87-14619
Construction of a digital height model based on simple finite elements — photogrammetry [SER-C-315] N87-14763
Multi-grid continuation and spurious solutions for nonlinear boundary value problems [AD-A173081] N87-14924
Applicability and limitations of probabilistic models in connection with the reliability of large installations [W-7/85] N87-14948
Finite element modeling of electromagnetic propagation in composite structures [NASA-TM-88916] N87-14956

FINITE VOLUME METHOD
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows [NASA-CR-4026] N87-14645

FINNED BODIES
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles [AD-A169531] N87-14647

FINS
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643

FIR FILTERS
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation [AD-A170855] N87-14601

FIRE DAMAGE
Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data [INPE-4035-RPE/522] N87-14764

FIRE PREVENTION
Cables and fire hazards [NASA-TM-88493] N87-14553

FITTINGS
In situ repair of a failed compression fitting [DE86-013682] N87-14707

FLAME PROBES
Flame diagnosis using coherent anti-Stokes Raman scattering (CARS) N87-14336

FLAME PROPAGATION
Multidimensional supersonic flow with supply of heat — flames N87-14337

FLAME RETARDANTS
Effect of the raw material composition of fabrics on the Limiting Oxygen Index (LOI) [NASA-TM-88483] N87-14463

FLAME TEMPERATURE
Flame diagnosis using coherent anti-Stokes Raman scattering (CARS) N87-14336

FLAMES
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames [AD-A169404] N87-14467
Evaluation of data on simple turbulent reacting flows [AD-A170071] N87-14648

FLAMMABILITY
Oxygen index: An approximate value for the evaluation of combustion characteristics [NASA-TM-88492] N87-14465

FLAPPING HINGES
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components [I-129/85] N87-14725

FLARE STARS
Molecular hydrogen in the young starburst in NGC 253 N87-15096

FLASH POINT
Discharges of saturated liquefied gases from pressure vessels N87-14545

FLAT PLATES
Investigations of the wake in a flow parallel to plates with blunt trailing edges [MPIS-3/1986] N87-14293

FLAT SURFACES
Detection and representation of planar surfaces in three dimensional range images [FOA-C-30427-E1] N87-14588

FLEXIBLE BODIES
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646
FLIGHT ALTITUDE
Survey of track keeping and altitudes on Heathrow and Gatwick Standard Instrument Departure routes — London airports
[CAA-PAPER-84018] N87-14308
FLIGHT CHARACTERISTICS
Deep stall characteristics of MU-300
[NASA-TM-88502] N87-14318
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353
FLIGHT CONTROL
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330
Archive data base and handling system for the Orbiter flying qualities experiment program
[NASA-CR-166622] N87-14351
Vehicle geometry effects on hypersonic stability and control N87-14397
FLIGHT CREWS
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982
[NASA-TM-88007] N87-14305
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859
FLIGHT HAZARDS
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325
FLIGHT MANAGEMENT SYSTEMS
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330
FLIGHT PATHS
Survey of track keeping and altitudes on Heathrow and Gatwick Standard Instrument Departure routes — London airports
[CAA-PAPER-84018] N87-14308
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
FLIGHT SAFETY
Wind shear and flight safety: A select bibliography
[CAA-PAPER-86003] N87-14300
Activities report in air traffic control
[ETN-87-98861] N87-14309
The simulator: The perfect illusion — flight simulator
[FACHTHEMEN-9] N87-14354
FLIGHT SIMULATION
Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate
[NLR-MP-85082-U] N87-14744
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
FLIGHT SIMULATORS
The simulator: The perfect illusion — flight simulator
[FACHTHEMEN-9] N87-14354
FLIGHT TRAINING
Activities report in air traffic control
[ETN-87-98861] N87-14309
FLOAT ZONES
Growth of a silicon single crystal by the floating-zone technique under micro-g conditions during Spacelab 1
[BMFT-FB-W-86-004] N87-14542
Liquid encapsulated float zone process and apparatus
[NASA-CASE-MFS-28144-1] N87-15004
FLOW CHARACTERISTICS
Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives
[ETN-87-98751] N87-14331
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
Jet mixing low — supersonic air flow N87-14339
Effect of Reynolds number on turbomachines N87-14346
Fundamentals of vortex motion N87-14631
Turbulent vortices N87-14634
Vortex breakdown in technology and nature N87-14638
FLOW DISTRIBUTION
Three-dimensional potential flow simulations for transonic inlets N87-14255
Computational study of flow in curved pipes with circular-section N87-14264
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290
Calculation and analysis of chemically reacting supersonic flows N87-14343
Prediction methods for the calculation of flow fields around reentry vehicles N87-14395
Compressibility effects on delta wing flow fields N87-14641
Compressibility effects on flows around simple components N87-14642
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus
[NASA-TM-88507] N87-15144
FLOW EQUATIONS
Multidimensional supersonic flow with supply of heat — flames N87-14337
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
FLOW MEASUREMENT
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643
Measurements of the low-wave-number structure of a turbulent boundary layer
[IC-AERO-85-01] N87-14657
Instationary flow effects in the rotor of a turbine
[ESA-TT-1001] N87-14663
Vibration-free Raman Doppler velocimeter
[NASA-CASE-LAR-13268-1] N87-14669
FLOW STABILITY
Investigation of Ferri instability in supersonic inlets
[ESA-TT-978] N87-14289
Jeans criterion in a turbulent medium N87-15065
FLOW THEORY
Vortex breakdown theories N87-14639
Possibilities and problems of the calculation of flow phenomena in combustion chambers
[ETN-86-98745] N87-14713
FLOW VISUALIZATION
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-98436] N87-14287
A three dimensional viscous vortex N87-14633
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14666
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698
FLOWMETERS
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290
FLUID DYNAMICS
Fluid dynamic problems in space systems N87-14402
FLUID FLOW
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-36] N87-14620
An introduction to heat tracing
[AD-A170677] N87-14653
FLUID MECHANICS
Activities report of the Laboratory of Mechanics and Energy Studies
[ETN-87-98577] N87-14558
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158
FLUID PRESSURE
The effect of changes in cerebrospinal fluid pressure on the labyrinth in terms of tympanic membrane displacement
[ISVR-TR-135] N87-14843
FLUORESCENCE
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
A precision laser spectrometer system
[AD-A170226] N87-14692
FLUOROHYDROCARBONS
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
FLUOROPOLYMERS
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
FLUTTER
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Remote pivot decoupler pylon: Wing/store flutter suppressor
[NASA-CASE-LAR-13173-1] N87-14314
FOCUSING
Optical Gaussian convolvers
[AD-D012438] N87-14976
FOLDING STRUCTURES
Foldable self-erecting joint
[NASA-CASE-MSC-20635-1] N87-14373
FORCE DISTRIBUTION
Device for quick changeover between wind tunnel force and pressure testing
[NASA-CASE-LAR-13512-1] N87-14675
FORCED CONVECTION
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629
FOREST FIRES
Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data
[INPE-4035-RPE/522] N87-14764
FORESTS
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
FORMALISM
Numerical modeling of aerosols N87-14548
FORMATIONS
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21)
[NASA-TM-88494] N87-15139
FOURIER TRANSFORMATION
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
Reduced tolerance imaging I
[AD-A170932] N87-14882
FRACTOGRAPHY
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
FRACTURE MECHANICS
Materials science in Europe
[AD-A170214] N87-14435
Nondestructive tests of Carbon Fiber Reinforced Plastics (CFRP) in the framework of damage mechanics investigations N87-14438

Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Acoustic emission analysis of Carbon Fiber Reinforced Plastics (CFRP) N87-14440
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170218] N87-14493
Micromechanics 2
[AD-A170580] N87-14735
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects
[AD-A170644] N87-14736
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
Experimental investigations of dynamic effects in impact tests
[W-1/85] N87-14749
Activities report in materials mechanics
[ISSN-0713-9958] N87-14750
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral
[GKSS-86/E/15] N87-14752

FRACTURE STRENGTH
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys
[AD-A170136] N87-14491
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527
Load interaction effects on fatigue crack propagation in steels of varying strength
[FFA-TN-1986-47] N87-14747

FRACTURES (MATERIALS)
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741

FRACTURING
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512

FREE CONVECTION
Analysis of conduction from a heated cubical element to a plane conducting wall, appendix A N87-14622
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629

FREE ELECTRON LASERS
Two-stage FEL (Free Electron Laser) research at KMS Fusion, Inc.
[AD-A170828] N87-14696

FREE FLIGHT
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370

FREE JETS
Calculation and analysis of chemically reacting supersonic flows N87-14343
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14686

FREEZING
An introduction to heat tracing
[AD-A170877] N87-14653

FREQUENCIES
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726

FREQUENCY DISCRIMINATORS
Acoustic emission frequency discrimination
[NASA-CASE-MSC-20467-1] N87-14676

FREQUENCY MEASUREMENT
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693

FREQUENCY SHIFT
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693

FREQUENCY STABILITY
Low phase noise oscillator
[NASA-CASE-GSC-13018-1] N87-14596

FRICTION
On contact problems of elasticity theory
[NASA-TM-88491] N87-14729

FROST
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554

FUEL INJECTION
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25089-1] N87-14420

FUMES
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operators are being subjected
[MOD-103/86] N87-14783

FURNACES
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513

G

GALACTIC CLUSTERS
A CS J = 2 1 survey of the galactic center region N87-15082

GALACTIC EVOLUTION
The clumpy circumstellar medium around young supernova remnants N87-15079
Chemical evolution in spiral and irregular galaxies N87-15097

GALACTIC NUCLEI
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035
Aperture synthesis observations of the molecular ring in the galactic center N87-15083
Cold atomic hydrogen in the inner galaxy N87-15085
The organic component of interstellar grains N87-15114

GALACTIC STRUCTURE
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093
Is OH abundance enhanced in tidally distorted galaxies? N87-15094
6 CM OH absorption in megamaser galaxies N87-15095

GALLIUM ARSENIDES
Large signal modeling and analysis of the GaAs MESFET
[AD-A170304] N87-15011
Hole transport and charge transfer in GaAs/InGaAs GaAs single strained quantum well structures
[DE86-016096] N87-15018

GAPS
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520

GAS ANALYSIS
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14788
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798

GAS CHROMATOGRAPHY
Electrochemical reduction of carbon dioxide
[AD-A169830] N87-14468

GAS COOLING
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350

GAS DENSITY
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126

GAS DYNAMICS
Interferometry — of spatial flows N87-14332
Local interstellar gasdynamical stability in spiral arm flow N87-15092

GAS EVOLUTION
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121

GAS FLOW
Rocket exhaust plume flow into space N87-14403
A numerical study of incompressible juncture flows
[NASA-TM-88319] N87-14644
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14788

GAS GENERATORS
Electrothermal gas generator: Development and qualification of the control electronics
[BMFT-FB-W-86-006] N87-14611

GAS JETS
Measurement of the velocity and temperature of ignition gas and the role of the particles in the ignition mechanism
[ISL-CO-241/85] N87-14479
Measurement of the velocity and temperature of ignition gas jets in a bed of confined inert powder
[ISL-CO-245/85] N87-14480

GAS LASERS
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694

GAS MIXTURES
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operators are being subjected
[MOD-103/86] N87-14783

GAS SPECTROSCOPY
Potential of high temperature mass spectrometry for the analysis of materials N87-14453

GAS TUNGSTEN ARC WELDING
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714

GAS TURBINE ENGINES
Scaled centrifugal compressor program
[NASA-CR-174912] N87-14349

GAS TURBINES
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350

GAS-SOLID INTERACTIONS
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249

GAUGE THEORY
Cosmic superstrings and related topics
[DE86-702738] N87-15133

GEOCHEMISTRY
Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456

GEODETIC SURVEYS
The Geoscience Laser Altimetry/Ranging System (GLARS)
[NASA-TM-87803] N87-14687
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766

GEOGRAPHY
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812

GEOLOGICAL SURVEYS
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21)
[NASA-TM-88494] N87-15139

GEOLOGY
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145

GEOMAGNETISM
Thule magnetic results, 1981
[ISBN-87-7478-263-0] N87-14799
Thule magnetic results, 1982
[ISBN-87-7478-264-9] N87-14800
Thule Geophysical Observatory magnetic results, 1984
[ISBN-87-7478-266-5] N87-14801
Solar-geophysical data number 502, June 1986. Part 1: (Prompt reports). Data for May 1986, April 1986 and late data
[PB86-224011] N87-14803

GEOMETRY
Direct numerical control in grid generation N87-14270

GEOPHYSICAL FLUIDS
Geophysical vortices and vortex rings N87-14635

GEOPHYSICAL OBSERVATORIES
Thule magnetic results, 1981
[ISBN-87-7478-263-0] N87-14799
Thule magnetic results, 1982
[ISBN-87-7478-264-9] N87-14800

Thule Geophysical Observatory magnetic results, 1984
[ISBN-87-7478-266-5] N87-14801
Solar-geophysical data number 502, June 1986. Part 1: (Prompt reports). Data for May 1986, April 1986 and late data
[PB86-224011] N87-14803
Solar-geophysical data number 502, June 1986. Part 2: (Comprehensive reports). Data for December 1985 and miscellanea
[PB86-224029] N87-14804

GEOPOTENTIAL
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811

GEOSYNCHRONOUS ORBITS
Analysis of rendezvous and docking in geostationary Earth orbit. Rider to comparison of future communications space segment concepts
[DM51-C/PL/FL/0099.82] N87-14364

GIMBALS
Spacecraft subsystem support structure
[AD-D012437] N87-14576

GLASS
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526

GLASS FIBER REINFORCED PLASTICS
A method for the manufacture of model helicopter rotor blades from glass fiber reinforced plastic
[RAE-TR-85040] N87-14316
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535

GLASS FIBERS
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414

GLAZES
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests
[NASA-TM-88821] N87-14487

GLOBAL POSITIONING SYSTEM
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766

GLOW DISCHARGES
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016

GOODNESS OF FIT
A fast graphical goodness of fit test for time series models
[AD-A170094] N87-14919

GRAIN BOUNDARIES
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021

GRAIN SIZE
Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115

GRAINS
Grain processes in massive star formation N87-15063
Identification of polycyclic aromatic hydrocarbons N87-15098

GRAND UNIFIED THEORY
Superunification, phase transitions and cosmology
[DE86-702955] N87-15134

GRANULAR MATERIALS
Organic grains in comets
[PREPRINT-122] N87-15137

GRAPH THEORY
The complexity of parallel algorithms
[AD-A172445] N87-14885
Location of the communication process network described in FP2 on a graph structure in order to implement the parallel processing of that language
[RR-606-IMAG-49-LIFIA-I] N87-14914

GRAPHIC ARTS
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837

GRAPHITE
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532

GRAPHITE-EPOXY COMPOSITES
Stress rupture of carbon fiber composite materials
[DE86-012854] N87-14443

GRAPHS (CHARTS)
Postexperimental plots with a HP 7550A plotter
[DE86-015501] N87-14866

GRATINGS (SPECTRA)
Laser physics and laser techniques
[AD-A171949] N87-14897
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962
Calibration of the fast 12-channel Electron Cyclotron Emission (ECE) spectrometer at Joint European Torus (JET)
[REPT-86-168] N87-14970

GRAVITATION
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132

GRAVITATIONAL COLLAPSE
Jeans criterion in a turbulent medium N87-15065

GRAVITATIONAL EFFECTS
Observations on behavior of liquid in weightlessness N87-14408

GRAVITY ANOMALIES
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797

GRAVITY GRADIOMETERS
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766

GRAY SCALE
Processing of gray-value image sequences
[BMFT-FB-DV-86-006] N87-14890

GRAZING INCIDENCE
FUSE/Lyman grant
[NASA-CR-180024] N87-14972

GREENLAND
The ice conditions in the Greenland waters, 1979
[ISBN-87-7478-261-4] N87-14827

GROUND STATE
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120

GROUND STATIONS
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823

GROUND TRACKS
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416

GROWTH
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473

GUIDANCE SENSORS
Development of a portable precision landing system
[NASA-TM-88247] N87-14310

GULF STREAM
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826

GUN LAUNCHERS
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14861

GUN PROPELLANTS
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537

GYROSCOPES
Analysis of DRIRU bearings and lubricant from solar max repair mission N87-14379
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974

H

HAFNIUM CARBIDES
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984

HALL EFFECT
Hole transport and charge transfer in GaAs/InGaAs GaAs single strained quantum well structures
[DE86-016096] N87-15018

HALLEY'S COMET
Comet P/Halley 1910, 1986: An objective-prism study N87-15130
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149

HALOGENATION
Non-aqueous primary cell
[AD-D012428] N87-14599

HALOS
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115

HAMILTONIAN FUNCTIONS
Constrained normalization of Hamiltonian systems and perturbed Keplerian motion
[CWI-PM-R8603] N87-14954

HARDNESS
Eddy current automation. Discrimination and selection software applied to hardness control
[CETIM-100-090] N87-14722

HARDWARE
Proceedings of the SMRM Degradation Study Workshop
[NASA-TM-89274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
The Main Electronics Box (MEB) of the HAO coronagraph/polarimeter N87-14376
Failure analysis and performance evaluation of NASA inertial reference unit (DRIRU 2) after 50 months of orbital operation N87-14378

HARMONIC ANALYSIS
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726

HARMONIC CONTROL
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910

HEART FUNCTION
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840

HEART RATE
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832

HEAT FLUX
Computation of flow through multistage turbomachines taking into account flow losses and heat fluxes N87-14347
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623

HEAT PIPES
Heat pipe experiment on SPAS 01 N87-14411
An introduction to heat tracing
[AD-A170877] N87-14653

HEAT RESISTANT ALLOYS
The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-88840] N87-14488
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170218] N87-14493
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498

HEAT SHIELDING
Results of examination of materials from the solar maximum recovery mission N87-14383
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414

HEAT STORAGE
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778

HEAT TOLERANCE
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
HEAT TRANSFER
An introduction to heat tracing
[AD-A170877] N87-14653
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170899] N87-14768
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15006
HEAT TRANSFER COEFFICIENTS
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652
HEAT TRANSMISSION
Multidimensional supersonic flow with supply of heat — flames N87-14337
HEAT TREATMENT
Fiber reinforced ceramic material
[NASA-CASE-LEW-14392-1] N87-14517
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
Active hold-down for heat treating
[NASA-CASE-NPO-16892-1-CU] N87-14704
HEATERS
An introduction to heat tracing
[AD-A170877] N87-14653
HEATING
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772
HEATING EQUIPMENT
An introduction to heat tracing
[AD-A170877] N87-14653
HEAVY IONS
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
HEIGHT
Construction of a digital height model based on simple finite elements — photogrammetry
[SER-C-315] N87-14763
HELICOPTER CONTROL
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[ESA-TT-979] N87-14352
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910
HELICOPTER DESIGN
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
HELICOPTERS
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282
Accidents to UK aircraft and to large jet and turbo-prop transport aircraft worldwide in 1984
[CAA-PAPER-85009] N87-14297
Accidents to United Kingdom aircraft and to large jet and turbo-prop transport aircraft worldwide in 1985
[CAA-PAPER-86005] N87-14301
HELIOSPHERE
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131
HELIUM
Balloon instrumentation engineering and development
[AD-A170225] N87-14678
HETEROCYCLIC COMPOUNDS
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527
HETERODYNING
Reduced tolerance imaging I
[AD-A170932] N87-14882
Heterodyne spectroscopy of planetary and stellar atmospheres at a wavelength of 11 micrometers
[MPE-198] N87-15040
HETEROJUNCTIONS
Novel Si-based materials and device structures by molecular beam epitaxy
[AD-A170061] N87-15009
Development of a planar heterojunction bipolar transistor for very high speed logic
[AD-A170063] N87-15010
HEURISTIC METHODS
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
HF LASERS
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
Phased Array Laser System (PALS)
[AD-A169635] N87-14689
HIERARCHIES
Conceptual clustering using relational information
[AD-A170874] N87-14911
HIGH ALTITUDE BALLOONS
Balloon instrumentation engineering and development
[AD-A170225] N87-14678
HIGH FREQUENCIES
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961
HIGH LEVEL LANGUAGES
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
PROLOG: An expert system building tool
[CWI-CS-R8616] N87-14893
Portable operating systems for network computers: Distributed operating systems support for group communications
[AD-A170113] N87-14905
HIGH PRESSURE
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
High-temperature, high-pressure optical cell
[NASA-CASE-MFS-26000-1] N87-14971
HIGH REYNOLDS NUMBER
A finite element method for high Reynolds number flow N87-14259
HIGH SPEED
High-speed propeller noise predictions: Effects of boundary conditions used in blade loading calculations
[NASA-TM-88913] N87-14957
HIGH STRENGTH ALLOYS
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys
[AD-A170136] N87-14491
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733
HIGH STRENGTH STEELS
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14506
HIGH TEMPERATURE
High-temperature corrosion and methods of its control
[PB86-229663] N87-14484
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate
[NASA-TM-88841] N87-14489
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
High-temperature, high-pressure optical cell
[NASA-CASE-MFS-26000-1] N87-14971
Survey of materials and device technologies for high-temperature (T300C) power semiconductor electronics
[DE86-015822] N87-15017
HIGH TEMPERATURE ENVIRONMENTS
High-temperature effect of hydrogen on sintered alpha-silicon carbide
[NASA-TM-88819] N87-14518
HIGH TEMPERATURE GASES
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
HIGH TEMPERATURE NUCLEAR REACTORS
Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452
HIGH TEMPERATURE TESTS
Potential of high temperature mass spectrometry for the analysis of materials N87-14453
The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
HILSCH TUBES
Computational study of three-dimensional wake structure N87-14272
HINGES
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413
HIPPOCAMPUS
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
HOLDERS
Active hold-down for heat treating
[NASA-CASE-NPO-16892-1-CU] N87-14704
HOLOGRAPHY
Study of double exposure holography of the 3-dimensional character of the flow around an airfoil profile in a wind tunnel
[NASA-TM-88486] N87-14673
Progress in holographic cinematography
[ISL-CO-243/85] N87-14680
Investigation of supermadiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698
HOOP COLUMN ANTENNAS
Development of the 15 meter diameter hoop column antenna
[NASA-CR-4036] N87-14366
HORIZONTAL ORIENTATION
Parameterization of overwater horizontal wind variability
[AD-A169331] N87-14807
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus
[NASA-TM-88507] N87-15144
HORN ANTENNAS
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
HOT CORROSION
High-temperature corrosion and methods of its control
[PB86-229663] N87-14484
HOT MACHINING
Development of a copy-peeling machine for machining the surface of hot rolled square billets
[BMFT-FB-HA-86-004] N87-14555
HOT PRESSING
A study of fatigue crack propagation in powder metallurgy hot isotatically pressed nickel-base alloy
[AD-A173211] N87-14497
HOT WORKING
Hot forming of thick plates
[CETIM-13-J-122] N87-14505
HOT-WIRE ANEMOMETERS
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
HULLS (STRUCTURES)
Rocket plume contamination and surface interaction effects — spacecraft structures N87-14405
HUMAN FACTORS ENGINEERING
Auditory warnings on the BAC 1-11 and the Boeing 747. An application of the guidelines of CAA Paper 82017
[CAA-PAPER-85004] N87-14303
On the pilot's behavior of detecting a system parameter change
[NASA-TM-88536] N87-14846
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
Anthropometry handbook
[AD-A170298] N87-14855
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14858
HUMAN PERFORMANCE
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859
HURRICANES
Time series prediction of hurricane landfall
[AD-A170742] N87-14815

HYBRID CIRCUITS
Investigations on a broadband 180 deg hybrid — waveguide
[DFVLR-FB-86-22] N87-14616
HYDRAULIC CONTROL
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals — in helicopters
[ESA-TT-979] N87-14352
HYDRAULIC EQUIPMENT
Passively activated prehensile digit for a robotic end effector
[NASA-CASE-NPO-16766-1-CU] N87-14705
HYDRAULIC JETS
Results of the tests carried out to study the physical parameters affecting the ultrasonic inspection made by transmission under water jet (SIRO), part 1
[I-114/85-PT-1] N87-14723
Results of the tests carried out to study the physical parameters affecting ultrasonic inspection made by transmission under water jets (SIRO), part 2
[I-126/85-PT-2] N87-14724
HYDRAULIC TEST TUNNELS
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
HYDRAZINES
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425
Electrochemical behavior of a titanium electrode in hydrazine solutions
[NASA-TM-88538] N87-14464
HYDROCARBONS
Identification of polycyclic aromatic hydrocarbons N87-15098
The possible existence of interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099
More interstellar emission features at 3.3-3.6 micrometers! N87-15100
Resolution of the 7.7 micrometers emission feature in NGC 7027 N87-15101
Spectroscopy and CCD-photography of extended red emission in reflection nebulae N87-15102
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103
HYDROGEN
Combustion process of hydrogen-air mixtures under technical conditions N87-14338
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Cold atomic hydrogen in the inner galaxy N87-15085
HYDROGEN CLOUDS
Neutral hydrogen cloud distances and the strength of the interstellar magnetic field N87-15086
The molecular content of the nearby galaxy from IRAS and HI observations N87-15087
Molecular hydrogen in the young starburst in NGC 253 N87-15096
HYDROGEN EMBRITTLEMENT
High-temperature effect of hydrogen on sintered alpha-silicon carbide
[NASA-TM-88819] N87-14518
HYDROGEN IONS
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14965
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967
HYDROGEN OXYGEN ENGINES
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424
HYDROGEN PRODUCTION
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
Photobiological hydrogen production in green algae and photosynthetic bacteria
[DE86-015918] N87-14833
HYDROLYSIS
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
HYDROMETALLURGY
Testing of high alloy steels for new hydrometallurgical processes and chemical plants
[BMFT-FB-T-86-055] N87-14506
HYDROXYL RADICALS
Is OH abundance enhanced in tidally distorted galaxies? N87-15094
6 CM OH absorption in megamaser galaxies N87-15095
HYPERBOLIC DIFFERENTIAL EQUATIONS
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
Stabilization of the Lax-Wendroff methods and a generalized one-step Runge-Kutta method for hyperbolic initial-value problems
[CWI-NM-R8613] N87-14929
HYPERBOLIC FUNCTIONS
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations
[AD-A170187] N87-14921
Multigrid solution of monotone second-order discretizations of hyperbolic conservation laws
[CWI-NM-R8611] N87-14955
HYPERSONIC FLOW
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
HYPERSONIC VEHICLES
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14280
Vehicle geometry effects on hypersonic stability and control N87-14397
HYPERVELOCITY WIND TUNNELS
Experience about the application and valuation of roughness strips for boundary layer transition control in wind tunnel tests in the high-speed range
[DFVLR-MITT-86-12] N87-14291
HYPSOGRAPHY
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140
HYSTERESIS
Nonlinear wave propagation study
[AD-A170201] N87-14572

I

ICE
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108
ICE FORMATION
Numerical simulation of an aircraft icing N87-14248
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325
The icing research aircraft Do28, D-IFMP of DFVLR and its measuring equipment
[ESA-TT-972] N87-14326
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812
The ice conditions in the Greenland waters, 1979
[ISBN-87-7478-261-4] N87-14827
ICE MAPPING
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set — X-band SLAR
[CNES-85/187T/CT/DRT/TIT/RL] N87-14828
ICE REPORTING
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary
[ESA-CR(P)-2215] N87-14769
The ice conditions in the Greenland waters, 1979
[ISBN-87-7478-261-4] N87-14827
IDENTIFYING
A review of methods of personal identity verification — computer information security
[NPL-DITC-73/86] N87-15022
IGNITION
Measurement of the velocity and temperature of ignition gas and the role of the particles in the ignition mechanism
[ISL-CO-241/85] N87-14479
Measurement of the velocity and temperature of ignition gas jets in a bed of confined inert powder
[ISL-CO-245/85] N87-14480
IGNITION LIMITS
Oxygen index: An approximate value for the evaluation of combustion characteristics
[NASA-TM-88492] N87-14465
IMAGE ANALYSIS
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
Detection and representation of planar surfaces in three dimensional range images
[FOA-C-30427-E1] N87-14588
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study
[NASA-CR-177900] N87-15150
IMAGE CONVERTERS
Optical Gaussian convolvers
[AD-D012438] N87-14976
IMAGE FILTERS
Measurement of parameters for nonlinear object-size filters in images
[ETN-87-98694] N87-14932
IMAGE INTENSIFIERS
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973
IMAGE PROCESSING
Autonomous vehicle navigation
[AD-A170379] N87-14311
Automatic picture transmission receivers for weather satellite images. A brief introduction and survey of some commercially-available equipment
[AD-A170359] N87-14574
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170684] N87-14767
Reduced tolerance imaging I
[AD-A170932] N87-14882
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
Surface reconstruction from planar contours
[AD-A171617] N87-14884
On hierarchical edge matching in digital images using distance transformations
[FOA-B-30094-E1] N87-14902
Measurement of parameters for nonlinear object-size filters in images
[ETN-87-98694] N87-14932
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973
Optical Gaussian convolvers
[AD-D012438] N87-14976
Wavelength-multiplexed imaging techniques using optical fibers
[DE86-013028] N87-14986
Processing of gray-value image sequences
[BMFT-FB-DV-86-006] N87-14990
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048
IMAGE RESOLUTION
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981
IMAGERY
CADISS: An onboard system for compression and decompression of imagery sensor signals
[NLR-MP-85045-U] N87-14868
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
IMAGES
Calibration of ETS videotapes
[AD-A168888] N87-14677
Optical Gaussian convolvers
[AD-D012438] N87-14976
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
IMAGING SPECTROMETERS
High spatial resolution passive microwave sounding systems
[NASA-CR-180025] N87-14568
IMAGING TECHNIQUES
Detection and representation of planar surfaces in three dimensional range images
[FOA-C-30427-E1] N87-14588
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725
Reduced tolerance imaging I
[AD-A170932] N87-14882

Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981
Wavelength-multiplexed imaging techniques using optical fibers
[DE86-013026] N87-14986
Processing of gray-value image sequences
[BMFT-FB-DV-86-006] N87-14990
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
Aperture synthesis observations of the molecular ring in the galactic center N87-15083
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140

IMIDES
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538

IMMOBILIZATION
Active hold-down for heat treating
[NASA-CASE-NPO-16892-1-CU] N87-14704

IMMUNOLOGY
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

IMPACT DAMAGE
An assessment of aircraft repair schemes for battle damage and permanent usage
[R946/8] N87-14246
Analysis of bird strikes reported by European airlines 1976-1980. Civil aircraft over 5700 kg (12 500 lb) maximum weight
[CAA-PAPER-84019] N87-14296
Analysis of bird strikes to United Kingdom registered aircraft 1983 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-85018] N87-14299
Analysis of bird strikes to United Kingdom aircraft 1984 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-86006] N87-14302
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423

IMPACT LOADS
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474

IMPACT TESTS
Experimental investigations of dynamic effects in impact tests
[W-1/85] N87-14749

IMPEDANCE
Underwater explosion modeling of an energy absorption system
[AD-A168860] N87-14646

IMPINGEMENT
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643

INCANDESCENCE
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695

INCIDENCE
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-98436] N87-14287
On 10-60 GHz G/T measurements using the Sun as a source: A preliminary study
[PB86-230034] N87-14595

INCOHERENT SCATTERING
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981

INCOMPRESSIBLE FLOW
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
A numerical study of incompressible juncture flows
[NASA-TM-88319] N87-14644

INCONEL (TRADEMARK)
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492

INDEPENDENT VARIABLES
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714
Measurement of parameters for nonlinear object-size filters in images
[ETN-87-98694] N87-14932

INDEXES (RATIOS)
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780

INDIUM ARSENIDES
Hole transport and charge transfer in GaAs/InGaAs GaAs single strained quantum well structures
[DE86-016098] N87-15018

INDOOR AIR POLLUTION
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operaters are being subjected
[MOD-103/86] N87-14783

INDUCTANCE
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694

INDUCTION HEATING
An introduction to heat tracing
[AD-A170877] N87-14653

INDUSTRIAL MANAGEMENT
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709

INDUSTRIAL SAFETY
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709

INELASTIC SCATTERING
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne
[MPIS-2/1986] N87-14475
Spectroscopy of the phonons on noble gas surfaces using helium atomic beam scattering
[MPIS-1/1986] N87-14968

INELASTIC STRESS
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate
[NASA-TM-88841] N87-14489

INERTIAL CONFINEMENT FUSION
Inertial fusion power for space applications
[DE86-011879] N87-14969

INERTIAL NAVIGATION
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974

INFINITE SPAN WINGS
On contact problems of elasticity theory
[NASA-TM-88491] N87-14729

INFORMATION DISSEMINATION
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589

INFORMATION RETRIEVAL
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170830] N87-15025

INFORMATION SYSTEMS
Organizations as information processing systems
[AD-A173362] N87-15026
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

INFORMATION THEORY
Conceptual clustering using relational information
[AD-A170874] N87-14911

INFORMATION TRANSFER
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873

INFRARED ABSORPTION
Studies of interstellar vibrationally-excited molecules N87-15119

INFRARED ASTRONOMY
Far-infrared investigation of the Taurus star-forming region using the IRAS database N87-15044
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048
Near-infrared observations of IRAS sources in and near dense cores N87-15061
More interstellar emission features at 3.3-3.6 micrometers! N87-15100
Spectroscopy and CCD-photography of extended red emission in reflection nebulae N87-15102
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103
Some recent infrared spectroscopy of interstellar processes N87-15107
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108
The shapes of the circumstellar silicate features N87-15111

INFRARED ASTRONOMY SATELLITE
IRAS observations of giant molecular clouds in the Milky Way N87-15089

INFRARED DETECTORS
Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy
[INPE-3992-PRE/992] N87-15005

INFRARED IMAGERY
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741

INFRARED INSTRUMENTS
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526

INFRARED RADIATION
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013
Models of polarized infrared emission from bipolar nebulae N87-15050
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
The molecular content of the nearby galaxy from IRAS and HI observations N87-15087
IRAS observations of giant molecular clouds in the Milky Way N87-15089

INFRARED SPECTRA
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049
Infrared spectra of WC10 planetary nebulae nuclei N87-15075
Mass return to the interstellar medium from highly-evolved carbon stars N87-15078
Identification of polycyclic aromatic hydrocarbons N87-15098
Resolution of the 7.7 micrometers emission feature in NGC 7027 N87-15101

INFRARED SPECTROPHOTOMETERS
Physical-chemical characterization of the 2220-3 resin in the AS4/2220-3 preimpregnated material, test report, part 1 — carbon-epoxy composite materials
[REPT-M4-475000-PT-1] N87-14533

INFRARED SPECTROSCOPY
Heterodyne spectroscopy of planetary and stellar atmospheres at a wavelength of 11 micrometers
[MPE-198] N87-15040
Near-infrared spectroscopy of planetary nebulae: How strong is the H2 emission? N87-15074

INFRARED WINDOWS
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979

INPUT/OUTPUT ROUTINES
Non-roman font generation via interactive computer graphics
[AD-A170614] N87-14880

INSPECTION
Reliability of in-service inspection of transport aircraft structures
[CAA-PAPER-85013] N87-14244
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing
[DE86-013681] N87-14719
Eddy current automation. Discrimination and selection software applied to hardness control
[CETIM-100-090] N87-14722
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726

INSTRUMENT LANDING SYSTEMS
Development of a portable precision landing system
[NASA-TM-88247] N87-14310

INTAKE SYSTEMS
Three-dimensional potential flow simulations for transonic inlets N87-14255

INTEGRAL EQUATIONS
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578

INTEGRALS
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
INTEGRATED CIRCUITS
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594
Swept frequency technique for dispersion measurement of microstrip lines
[NASA-TM-88836] N87-14597
A survey of algorithms for integrating wafer-scale systolic arrays
[AD-A171623] N87-14602
Methodology verification of hierarchically described VLSI circuits
[AD-A171742] N87-14605
Improved signal delay bounds for RC tree networks
[AD-A169625] N87-14874
MOS circuit models in network C
[AD-A169951] N87-14876
Coordinate free LAP
[AD-A169962] N87-14877
Report on an interlaboratory electromigration experiment
[AD-A169652] N87-15006
INTERCEPTION
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415
INTERFACES
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14489
Model for bimetallic interfaces
[DE86-702901] N87-14500
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
INTERFACIAL TENSION
Surface tension minimum and Marangoni convection — reduced gravity experiments N87-14409
INTERFEROMETRY
Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
INTERIM STAGES (SPACECRAFT)
Winged space transporters: The problem of the number of stages — reusable launch vehicles
[ETN-87-98863] N87-14367
INTERIOR BALLISTICS
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14661
INTERLAYERS
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
INTERMETALLICS
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
INTERNAL COMBUSTION ENGINES
Possibilities and problems of the calculation of flow phenomena in combustion chambers
[ETN-86-98745] N87-14713
INTERNATIONAL COOPERATION
Composition of the WMO
[WMO/OMM-5] N87-14820
Strategic defense initiative and the prospects for international cooperation in space
[DE86-016153] N87-15029
INTERPLANETARY DUST
The possible existence of interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
INTERPROCESSOR COMMUNICATION
Performance evaluation and control of distributed computer communication networks
[AD-A170810] N87-14579
Distributed control in computer networks and cross sections of colored multidimensional bodies
[CWI-CS-R8611] N87-14906
INTERSTELLAR CHEMISTRY
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
INTERSTELLAR EXTINCTION
Near-infrared observations of IRAS sources in and near dense cores N87-15061
Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069
Unusual relative strengths of the diffuse interstellar bands in some interstellar dust clouds N87-15105
Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109
Depletions and extinction curves for lines of sight through the outer edges of truly dense molecular clouds N87-15110
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112
Translucent molecular clouds: Theory and observations N87-15117
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124
INTERSTELLAR GAS
Supershells and propagating star formation N87-15067
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
Observational discrimination between modes of shock propagation in interstellar clouds: Predictions of CH+ and SH+ column densities in diffuse clouds N87-15081
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
Milky Way halo gas kinematics N87-15088
Local interstellar gasdynamical stability in spiral arm flow N87-15092
Studies of interstellar vibrationally-excited molecules N87-15119
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126
INTERSTELLAR MAGNETIC FIELDS
Neutral hydrogen cloud distances and the strength of the interstellar magnetc field N87-15066
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126
Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127
INTERSTELLAR MASERS
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
6 CM OH absorption in megamaser galaxies N87-15095
INTERSTELLAR MATTER
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
MM and subMM molecular line observations of the southwest lobe of L1551: Evidence of a shell structure N87-15045
High resolution observations of the L1551 bipolar outflow N87-15046
A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4" resolution N87-15047
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
The bird: A pressure-confined explosion in the interstellar medium N87-15062
Grain processes in massive star formation N87-15063
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
Size-density relations in dark clouds: Non-LTE effects N87-15068
Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069
Planetary nebulae and the interstellar medium N87-15076
Mass return to the interstellar medium from highly-evolved carbon stars N87-15078
Chemical evolution in spiral and irregular galaxies N87-15097
Infrared studies of supernova remnants with the IRAS N87-15104
Unusual relative strengths of the diffuse interstellar bands in some interstellar dust clouds N87-15105
Some recent infrared spectroscopy of interstellar processes N87-15107
The organic component of interstellar grains N87-15114
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115
Molecular catastrophes and the formation of circumstellar dust N87-15116
Translucent molecular clouds: Theory and observations N87-15117
Do large rate coefficients for ion-polar neutral reactions have a serious effect on chemical models of dense clouds? N87-15118
INVARIANCE
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14933
INVERSE SCATTERING
Renormalization of an inverse scattering theory for Gaussian dielectric profiles
[AD-A169328] N87-14571
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981
INVERSIONS
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
INVESTIGATION
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428
Thermographic investigation on the thermoelastic effect in metals
[DE86-702966] N87-14501
ION BEAMS
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
Carbon whisker study
[AD-A170345] N87-15012
ION CURRENTS
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525
ION ENGINES
Electric propulsion options for the SP-100 reference mission
[NASA-TM-88918] N87-14422
ION IRRADIATION
Carbon whisker study
[AD-A170345] N87-15012
ION PROPULSION
Field emission electric propulsion. Industrial development of emitters modules, phase 1B
[TS/SL/194/DV/30.094/82] N87-14429
ION SOURCES
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14965
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967
IONIC COLLISIONS
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
IONIC REACTIONS
Ionic deposits
[CETIM-12-F-362] N87-14504
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796
IONIZATION
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060

IONIZED GASES
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds
N87-15060

IRON ALLOYS
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477
Development of a suitable powder metal on iron base for general use in highly loaded slide bearings
[BMFT-FB-T-86-056] N87-14507

IRRADIATION
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003

IRREGULAR GALAXIES
Chemical evolution in spiral and irregular galaxies
N87-15097

ISOSTATIC PRESSURE
A study of fatigue crack propagation in powder metallurgy hot isostatically pressed nickel-base alloy
[AD-A173211] N87-14497

ISOTHERMAL PROCESSES
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477

ITERATION
Reduced tolerance imaging I
[AD-A170932] N87-14882

ITERATIVE SOLUTION
Transonic wing and airfoil design using inverse code WINDES N87-14275
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924
A monograph on Kepler's equation
[RAE-TR-85080] N87-14951

J

J INTEGRAL
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral
[GKSS-86/E/15] N87-14752

JEANS THEORY
Jeans criterion in a turbulent medium N87-15065

JET AIRCRAFT
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353

JET FLOW
Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet
[NASA-TM-86922] N87-14283
A calculation method for the propulsive jet and its aerodynamic interf on with an afterbody
[DFVLR-FB-86-29] N87-14292
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407

JET IMPINGEMENT
Dynamic aspects of rocket plume impingement
N87-14404

JET MIXING FLOW
Jet mixing low — supersonic air flow N87-14339

JET PROPULSION
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292

JOINT EUROPEAN TORUS
Calibration of the fast 12-channel Electron Cyclotron Emission (ECE) spectrometer at Joint European Torus (JET)
[REPT-86-168] N87-14970

JOINTS (JUNCTIONS)
Foldable self-erecting joint
[NASA-CASE-MSC-20635-1] N87-14373
In situ repair of a failed compression fitting
[DE86-013682] N87-14707
Deformations of connections, the Riemann Hilbert problem and tau functions
[CWI-PM-M8602] N87-14953

JUPITER (PLANET)
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041

K

KAPITZA RESISTANCE
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

KAPTON (TRADEMARK)
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Teflon, Kapton surface and bulk effects N87-14390
Solar maximum thermal surface assessment
N87-14393
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449

KEPLER LAWS
A monograph on Kepler's equation
[RAE-TR-85080] N87-14951
Constrained normalization of Hamiltonian systems and perturbed Keplerian motion
[CWI-PM-R8603] N87-14954

KERR MAGNETOOPTICAL EFFECT
Laser physics and laser techniques
[AD-A171949] N87-14697

KEYING
A model of typing performance with respect to mental load factors — computer operators
[DRIC-T-7770] N87-14844

KINEMATICS
Spacelab Lyman Alpha-White Light Coronagraph Program
[NASA-CR-177902] N87-14674
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035
Milky Way halo gas kinematics N87-15088

KINETIC ENERGY
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions
N87-15125

KINETIC EQUATIONS
Polarizability of a crystal with impurities
[DE86-702900] N87-15014

KINETICS
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836

KNOWLEDGE
Knowledge representation and inference in rule-based systems
[CWI-CS-R8613] N87-14891
A general object-centered database language (GODEL): A preliminary definition
[CWI-CS-R8615] N87-14892

KNUDSEN GAGES
Potential of high temperature mass spectrometry for the analysis of materials N87-14453

KRYPTON
Thermal extraction of krypton in aluminum using a mass spectrometer N87-14462

L

LABORATORIES
Advanced chemical analysis service at the Nuclear Research Center, Juelich, West Germany N87-14454

LABORATORY EQUIPMENT
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691

LABYRINTH
The effect of changes in cerebrospinal fluid pressure on the labyrinth in terms of tympanic membrane displacement
[ISVR-TR-135] N87-14843

LAGRANGE MULTIPLIERS
Study of phenomena of unsteady boundary-layer separation
[AD-A170428] N87-14649

LAMINAR BOUNDARY LAYER
Application of the e sup N method to calculations of laminar flow control N87-14263
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14865

LAMINAR FLOW
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Stratification phenomena and associated hazards
N87-14549
A numerical study of incompressible juncture flows
[NASA-TM-88319] N87-14644

LAMINAR HEAT TRANSFER
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170656] N87-14652

LAMINATES
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983

LAND
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765

LAND USE
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770

LANDING GEAR
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323

LANDING LOADS
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323

LANDING SITES
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356

LANDSAT SATELLITES
Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data
[INPE-4035-RPE/522] N87-14764

LANTHANUM OXIDES
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979

LARGE SCALE INTEGRATION
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594

LARGE SPACE STRUCTURES
Development of the 15 meter diameter hoop column antenna
[NASA-CR-4038] N87-14366
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

LASER ALTIMETERS
The Geoscience Laser Altimetry/Ranging System (GLARS)
[NASA-TM-87803] N87-14687

LASER APPLICATIONS
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests
[NASA-TM-88821] N87-14487
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Laser physics and laser techniques
[AD-A171949] N87-14697
Activities of the 1st International Laser Science Conference
[AD-A173080] N87-14699
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756

Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
High-temperature, high-pressure optical cell
[NASA-CASE-MFS-26000-1] N87-14971

LASER CAVITIES
Resonator internal absorption and nonlinear dynamics of multimode laser systems
[MPE-197] N87-14684
Dynamics of multimode lasers N87-14686
Two-stage FEL (Free Electron Laser) research at KMS Fusion, Inc.
[AD-A170828] N87-14696
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993

LASER DOPPLER VELOCIMETERS
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643
Vibration-free Raman Doppler velocimeter
[NASA-CASE-LAR-13268-1] N87-14669
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698

LASER HEATING
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14965

LASER INDUCED FLUORESCENCE
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796

LASER INTERFEROMETRY
Interferometry — of spatial flows N87-14332
Zeeman Laser Scattering (ZLS): A new light scattering technique
[DE86-012443] N87-14700

LASER OUTPUTS
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964

LASER PUMPING
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963

LASER RANGE FINDERS
The Geoscience Laser Altimetry/Ranging System (GLARS)
[NASA-TM-87803] N87-14687

LASER SPECTROMETERS
A precision laser spectrometer system
[AD-A170226] N87-14692

LASER SPECTROSCOPY
Laser-photoacoustic spectroscopy of air pollutants
[M-19] N87-14787

LASER WEAPONS
Phased Array Laser System (PALS)
[AD-A169635] N87-14689

LASERS
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
Activities of the 1st International Laser Science Conference
[AD-A173060] N87-14699

LATE STARS
Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects
N87-15105

LATENT HEAT
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170899] N87-14788

LATTICE VIBRATIONS
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961

LAVA
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21)
[NASA-TM-88494] N87-15139
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus
[NASA-TM-88507] N87-15144

LAYOUTS
Coordinate free LAP
[AD-A169982] N87-14677

LEADERSHIP
Organizations as information processing systems
[AD-A173382] N87-15026

LEADING EDGES
Numerical simulation of vortical flow N87-14640
Noise development in transonic flows at the impact of vortices on a profile leading edge
[MPIS-5/1986] N87-14960

LEAKAGE
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604

LEAST SQUARES METHOD
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-606-IMAG-M] N87-14949

LENSES
Optical Gaussian convolvers
[AD-D012438] N87-14976
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985

LIAPUNOV FUNCTIONS
Interaction of diffusion and boundary conditions
[AD-A170217] N87-14922

LIBRATIONAL MOTION
Stationkeeping of libration point orbits, executive summary
[ESA-CR(P)-2272] N87-14383

LIE GROUPS
Intertwining functions in compact Lie groups and multivariable orthogonal polynomials
[CWI-PM-R8601] N87-14952

LIFE (DURABILITY)
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests
[NASA-TM-88821] N87-14487
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873

LIFE SUPPORT SYSTEMS
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860

LIFTING ROTORS
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282

LIGANDS
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538

LIGHT (VISIBLE RADIATION)
Laser physics and laser techniques
[AD-A171949] N87-14897

LIGHT AMPLIFIERS
Pulse shaping with transmission lines
[DE86-013674] N87-14608
Phased Array Laser System (PALS)
[AD-A169635] N87-14689

LIGHT BEAMS
Double window viewing chamber assembly
[NASA-CASE-MFS-28057-1] N87-14355
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695

LIGHT MODULATION
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980

LIGHT SCATTERING
Zeeman Laser Scattering (ZLS): A new light scattering technique
[DE86-012443] N87-14700
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108

LIGHT VALVES
Liquid crystal materials and electrooptic effects for high information content displays
[BMFT-FB-T-86-018] N87-14988

LINE OF SIGHT
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837

LINE SHAPE
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962

LINE SPECTRA
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
Optical observations of very low ionization HII regions in the large Magellanic cloud N87-15072
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
Infrared spectra of WC10 planetary nebulae nuclei N87-15075
A CS J = 2 1 survey of the galactic center region N87-15082
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
6 CM OH absorption in megamaser galaxies N87-15095
Molecular hydrogen in the young starburst in NGC 253 N87-15096
Translucent molecular clouds: Theory and observations N87-15117
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123
Comet P/Halley 1910, 1986: An objective-prism study N87-15130

LINEAR EQUATIONS
NUMVEC FORTRAN library manual. Chapter: Simultaneous linear equations
[CWI-NM-R8614] N87-14896
Limiting behavior of linearly damped hyperbolic equations
[AD-A170161] N87-14920

LINEAR POLARIZATION
Models of polarized infrared emission from bipolar nebulae N87-15050

LINEAR SYSTEMS
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-98591] N87-14904
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980

LINEARITY
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14933

LINES (GEOMETRY)
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170884] N87-14767

LIQUEFACTION
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539

LIQUEFIED GASES
Discharges of saturated liquefied gases from pressure vessels N87-14545

LIQUID CHROMATOGRAPHY
Physical-chemical characterization of the 2220-3 resin in the AS4/2220-3 preimpregnated material, test report, part 1 — carbon-epoxy composite materials
[REPT-M4-475000-PT-1] N87-14533

LIQUID CRYSTALS
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980
Liquid crystal materials and electrooptic effects for high information content displays
[BMFT-FB-T-86-018] N87-14988

LIQUID FLOW
Observations on behavior of liquid in weightlessness N87-14406

LIQUID FUELS
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537

LIQUID METALS
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499

The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170656] N87-14852

LIQUID OXYGEN
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25989-1] N87-14420
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426

LIQUID PHASE EPITAXY
Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy
[INPE-3992-PRE/992] N87-15005

LIQUID ROCKET PROPELLANTS
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25989-1] N87-14420
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425

LIQUID SLOSHING
Forced motion on spinning test for slosh-moment investigations — spacecraft stability N87-14406
Preliminary results from the EMTE fuel slosh flight experiment — STS-16 N87-14410

LITERATURE
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032

LITHIUM FLUORIDES
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

LITHIUM SULFUR BATTERIES
Dual battery connector arrangement
[AD-D012544] N87-14607

LITHOSPHERE
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus
[NASA-TM-88507] N87-15144
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145

LOAD DISTRIBUTION (FORCES)
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732

LOAD TESTS
Load interaction effects on fatigue crack propagation in steels of varying strength
[FFA-TN-1986-47] N87-14747

LOADS (FORCES)
Development of the highly loaded axial flow turbine airfoils, making use of the improved inverse channel flow design method N87-14257
Force sensor based on the magnetoelastic effect
[ETN-86-98719] N87-14681
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732

LOCAL AREA NETWORKS
Performance evaluation and control of distributed computer communication networks
[AD-A170610] N87-14579

LOCKING
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703

LOG PERIODIC ANTENNAS
A log - periodic HF antenna system
[AD-D012527] N87-14581

LOGIC CIRCUITS
Design of Programmable Logic Arrays (PLA) CMOS
[ETN-87-96590] N87-14617

LOGISTICS
Post-Challenger assessment of space shuttle flight rates and utilization
[NASA-CR-180105] N87-14368

LONGITUDINAL CONTROL
Remote pivot decoupler pylon: Wing/store flutter suppressor
[NASA-CASE-LAR-13173-1] N87-14314

LOOP ANTENNAS
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312

LOSSES
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077

LOW COST
Development of a portable precision landing system
[NASA-TM-88247] N87-14310

LOW GRAVITY MANUFACTURING
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

LOW PASS FILTERS
Design of filters for the vertical subsampling of color difference signals at half the sampling rate — color television
[FI-447-TB-19] N87-14587

LOW TEMPERATURE
Low temperature silicon oxidation studies
[AD-A169699] N87-14470

LUBRICANTS
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524

LUMINANCE
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14813

LUMINESCENCE
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449

LUMINOSITY
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059

LUMINOUS INTENSITY
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695
Pervasive small-scale structure in molecular clouds N87-15055

LUNAR RETROREFLECTORS
Models for the prediction of polar coordinates of lunar reflectors in the dynamic Earth-Moon system
[REPT-69] N87-14701

LUNGS
Micromechanics 2
[AD-A170560] N87-14735
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840

LYMAN ALPHA RADIATION
Spacelab Lyman Alpha-White Light Coronagraph Program
[NASA-CR-177902] N87-14674

LYMAN SPECTRA
FUSE/Lyman grant
[NASA-CR-180024] N87-14972

M

M STARS
The shapes of the circumstellar silicate features N87-15111
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112

MACH-ZEHNDER INTERFEROMETERS
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[ESA-TT-980] N87-14994

MACHINE TOOLS
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709

MAGELLANIC CLOUDS
Optical observations of very low ionization HII regions in the large Magellanic cloud N87-15072

MAGNESIUM OXIDES
High temperature properties and processes in ceramics: Thermomigration
[DE86-015035] N87-14531

MAGNETIC DISTURBANCES
Thule magnetic results, 1982
[ISBN-87-7478-264-9] N87-14800

MAGNETIC DOMAINS
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013

MAGNETIC FIELDS
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study
[NASA-CR-177900] N87-15150

MAGNETIC FLUX
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791

MAGNETIC MEASUREMENT
Neutral hydrogen cloud distances and the strength of the interstellar magnetic field N87-15086

MAGNETIC MOMENTS
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013

MAGNETIC TRANSDUCERS
Force sensor based on the magnetoelastic effect
[ETN-86-98719] N87-14681

MAGNETIC VARIATIONS
Thule magnetic results, 1981
[ISBN-87-7478-263-0] N87-14799
Thule Geophysical Observatory magnetic results, 1984
[ISBN-87-7478-266-5] N87-14801

MAGNETOHYDRODYNAMIC STABILITY
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001

MAGNETOHYDRODYNAMIC TURBULENCE
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999

MAGNETOHYDRODYNAMIC WAVES
Antenna optimization for Alfven wave heating
[IPP-4/228] N87-14592
Experimental evidence of MHD surface wave
[ISSN-0469-4732] N87-14997
Models for application of radiation boundary condition for MHD waves in collapse calculations N87-15128
Magnetic braking in weakly ionized circumstellar disks N87-15129

MAGNETOHYDRODYNAMICS
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153

MAGNETOMETERS
Postflight evaluation of the solar maximum spacecraft magnetometers N87-14380
Balloon instrumentation engineering and development
[AD-A170225] N87-14678
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14996

MAGNETOSTATICS
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654

MAGNETOSTRICTION
Force sensor based on the magnetoelastic effect
[ETN-86-98719] N87-14681

MAGNITUDE
Redetermination of earthquake body-wave magnitudes (m sub b) using ISC bulletin data — International Seismological Center (ISC)
[AWRE-O-21/85] N87-14790

MAGNUS EFFECT
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14847

MAINTENANCE
Remote operation and maintenance demonstration facility at the Oak Ridge National Laboratory
[DE86-012621] N87-14706
In situ repair of a failed compression fitting
[DE86-013682] N87-14707
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
Stochastic convexity and its applications
[AD-A170112] N87-14939

MAN MACHINE SYSTEMS
Remote operation and maintenance demonstration facility at the Oak Ridge National Laboratory
[DE86-012621] N87-14706

The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838

MAN-COMPUTER INTERFACE
Database oriented UNIX operating environment and its application N87-14253
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14858

MANAGEMENT ANALYSIS
Compendium of research
[AD-A170356] N87-15024

MANEUVERABLE SPACECRAFT
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415

MANGANESE
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512

MANIFOLDS (MATHEMATICS)
Deformations of connections, the Riemann Hilbert problem and tau functions
[CWI-PM-M8602] N87-14953

MANNED MANEUVERING UNITS
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370

MANNED SPACECRAFT
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860

MAPPING
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
Surface reconstruction from planar contours
[AD-A171617] N87-14884
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103

MARANGONI CONVECTION
Surface tension minimum and Marangoni convection — reduced gravity experiments N87-14409

MARINE ENVIRONMENTS
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485

MARINE TECHNOLOGY
Materials science in Europe
[AD-A170214] N87-14435

MARKERS
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698

MARKET RESEARCH
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589

MARKOV PROCESSES
Stationary Markov sets
[AD-A170109] N87-14938
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943

MARS (PLANET)
Phobos and Deimos: Satellites of Mars
[NASA-TM-88016] N87-15142

MARTINGALES
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-606-IMAG-M] N87-14949

MASERS
Soviet development of gyrotrons
[AD-A169680] N87-14690

MASS
Size-density relations in dark clouds: Non-LTE effects N87-15068

MASS SPECTROMETERS
Potential of high temperature mass spectrometry for the analysis of materials N87-14453
Thermal extraction of krypton in aluminum using a mass spectrometer N87-14482

MASS SPECTROSCOPY
Mass spectrometric concentration measurements in supersonic flows with chemical reactions N87-14334
Analysis of ferrous materials — mass spectrometry N87-14451
Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524

MATCHING
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875

MATERIALS HANDLING
C-130/C-141 center vertical restraint
[AD-A170438] N87-14320

MATHEMATICAL MODELS
Numerical simulation of an aircraft icing N87-14248
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1
[DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual
[DOT/FAA/CT-86/25-2] N87-14307
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325
Transonic and supersonic compressors N87-14344
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
Rocket exhaust plume flow into space N87-14403
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Modeling of telecommunication systems operated with advanced capacity reservation
[ENST-86E006] N87-14586
Analysis of conduction from a heated cubical element to a plane conducting wall, appendix A N87-14622
Radiation from an element in an array to its surroundings, appendix C N87-14624
Modeling three dimensional vortex flow in aerodynamics N87-14636
Models for the prediction of polar coordinates of lunar reflectors in the dynamic Earth-Moon system
[REPT-69] N87-14701
The modelling of creep for engineering design-1 — metals, ceramics
[NPL-DMA-A115] N87-14727
An extended mathematical model of aerotriangulation for highly precise point determination
[SER-C-316] N87-14762
Construction of a digital height model based on simple finite elements — photogrammetry
[SER-C-315] N87-14763
Applied system analysis no. 45: SOLARYS, an interactive model for the simulation of solar systems, parts 1 and 2 — solar energy
[JUEL-SPEZ-346-PT-1-PT-2] N87-14775
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797
Alternative mathematical programming formulations for FSS synthesis
[NASA-CR-180030] N87-14872
Model reduction of sampled data systems
[OUEL-1625/86] N87-14930
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948
Binary time series with reward. Application to climatology modeling
[ETN-87-98588] N87-14950
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
Distributed charge model MOS transistors
[ENST-86D003] N87-15019
Verification and modification of the dc MOS-transistor model of Poorter
[E-EEA/323/10/1984] N87-15020
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153

MATHEMATICAL PROGRAMMING
Alternative mathematical programming formulations for FSS synthesis
[NASA-CR-180030] N87-14872

MATRICES (MATHEMATICS)
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-98591] N87-14904
Systolic networks for the solution of linear problems
[ETN-87-98589] N87-14909
Parallel matrix computations
[AD-A170699] N87-14923
Lower bounds for a class of Kostka numbers
[CWI-CS-R8614] N87-14925

MATRIX MATERIALS
The possible existence of interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099

MAXIMUM LIKELIHOOD ESTIMATES
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942

MECHANICAL PROPERTIES
Elementary characterization of the AS4/2220.3 Hercules prepreg
[CEAT-M4-475-000] N87-14448
Ionic deposits
[CETIM-12-F-362] N87-14504
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
Activities report of the Laboratory of Mechanics and Energy Studies
[ETN-87-98577] N87-14558
Activities report in materials mechanics
[ISSN-0713-9956] N87-14750
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979

MECHANICAL TWINNING
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14496

MEDITERRANEAN SEA
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
Numerical simulations of the circulation of the eastern Mediterranean
[AD-A170219] N87-14825

MELTS (CRYSTAL GROWTH)
High-temperature, high-pressure optical cell
[NASA-CASE-MFS-26000-1] N87-14971
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008

MEMBRANE STRUCTURES
The effect of changes in cerebrospinal fluid pressure on the labyrinth in terms of tympanic membrane displacement
[ISVR-TR-135] N87-14843

MEMORY (COMPUTERS)
Techniques to achieve high-speed computations in supercomputers N87-14250
Real-time garbage collection for list processing
[NASA-CASE-MSC-20964-1] N87-14863

MENTAL PERFORMANCE
A model of typing performance with respect to mental load factors — computer operators
[DRIC-T-7770] N87-14844

MESOSCALE PHENOMENA
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816

METAL BONDING
Elucidation of the adhesion mechanisms in structural aluminum bondings
[BMFT-FB-W-86-006] N87-14534
METAL COATINGS
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482
METAL FATIGUE
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741
Load interaction effects on fatigue crack propagation in steels of varying strength
[FFA-TN-1986-47] N87-14747
METAL FIBERS
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578
METAL MATRIX COMPOSITES
Production of aluminum-silicon carbide composites
[ETN-86-98696] N87-14446
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731
METAL OXIDE SEMICONDUCTORS
Improved signal delay bounds for RC tree networks
[AD-A169625] N87-14874
MOS circuit models in network C
[AD-A169951] N87-14876
Distributed charge model MOS transistors
[ENST-86D003] N87-15019
Verification and modification of the dc MOS-transitor model of Poorter
[E-EEA/323/10/1984] N87-15020
METAL PLATES
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652
METAL SHEETS
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14508
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
METAL SHELLS
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
METAL SURFACES
The 7th Symposium on Applied Surface Analysis
[AD-A169840] N87-14469
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962
METAL VAPORS
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
METAL WORKING
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
METALLICITY
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124
METALS
Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods
[JUEL-CONF-55] N87-14450
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
Thermographic investigation on the thermoelastic effect in metals
[DE86-702986] N87-14501
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538
The modelling of creep for engineering design-1 — metals, ceramics
[NPL-DMA-A115] N87-14727
Micromechanics 2
[AD-A170560] N87-14735
Activities report in materials mechanics
[ISSN-0713-9956] N87-14750
METEORITIC DAMAGE
Analysis of micrometeorite material captured by the solar max satellite N87-14385
Examination of returned solar-max surfaces for impacting orbital debris and meteoroids N87-14386
A preliminary report on the study of the impact sites and particles of the solar maximum satellite thermal blanket N87-14387
METEOROIDS
Examination of returned solar-max surfaces for impacting orbital debris and meteoroids N87-14386
METEOROLOGICAL CHARTS
World weather extremes: Revision
[AD-A170138] N87-14810
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811
METEOROLOGICAL PARAMETERS
Remote detection of aircraft icing conditions using microwave radiometers
[PB88-229507] N87-14806
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on conventional meteorological variables
[AD-A169478] N87-14808
World weather extremes: Revision
[AD-A170138] N87-14810
Development of Test Reference Years (TRY) for climatic regions in the Federal Republic of Germany
[BMFT-FB-T-86-051] N87-14818
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915
METEOROLOGICAL RADAR
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170699] N87-14768
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814
METEOROLOGICAL RESEARCH AIRCRAFT
The icing research aircraft Do28, D-IFMP of DFVLR and its measuring equipment
[ESA-TT-972] N87-14326
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
METEOROLOGICAL SATELLITES
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170699] N87-14768
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
METEOROLOGICAL SERVICES
The data circulation mission in the Meteosat 2000 program
[ESA-CR(P)-2221] N87-14817
METEOROLOGY
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
METEOSAT SATELLITE
The data circulation mission in the Meteosat 2000 program
[ESA-CR(P)-2221] N87-14817
METHOD OF CHARACTERISTICS
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249
METHYL COMPOUNDS
HC3N maps of OMC1 N87-15056
MICROBURSTS
Stability of a shear model in which perturbations move with the mean local flow
[PB86-232469] N87-14805
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814
MICROCOMPUTERS
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
Universal microcomputer for the control of electronic equipment
[GSI-86-12] N87-14870
Enhanced simulation output through the use of spreadsheet software
[AD-A170671] N87-14881
MICROELECTRONICS
Special techniques for the Auger analysis of microelectronic devices
[AD-A171631] N87-14603
MICROMECHANICS
Micromechanics 2
[AD-A170560] N87-14735
MICROMETEORITES
Analysis of micrometeorite material captured by the solar max satellite N87-14385
MICROMETERS
A preliminary report on the study of the impact sites and particles of the solar maximum satellite thermal blanket N87-14387
MICROPROCESSORS
Contribution to the study of a monolithic 32 bit processor in CMOS technology
[ETN-87-98592] N87-14618
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14872
BACON-52 single board controller
[DIGEL-88] N87-14869
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871
Microprocessor controlled optical measuring system for large mirror modules
[ESA-TT-964] N87-14995
MICROSCOPES
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594
MICROSCOPY
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
MICROSEISMS
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792
MICROSTRIP TRANSMISSION LINES
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Swept frequency technique for dispersion measurement of microstrip lines
[NASA-TM-88836] N87-14597
MICROSTRUCTURE
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels
[BLL-CE-TRANS-8252-(9022.09)] N87-14481
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503
MICROWAVE CIRCUITS
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Swept frequency technique for dispersion measurement of microstrip lines
[NASA-TM-88836] N87-14597
MICROWAVE IMAGERY
Microwave measurement of the combustion velocity of solid propellants (4)
[ONERA-RTS-11/3173-EY] N87-14476
MICROWAVE SOUNDING
High spatial resolution passive microwave sounding systems
[NASA-CR-180025] N87-14568
MICROWAVES
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14961
MIE SCATTERING
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108

MILITARY SPACECRAFT
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230620] N87-15023
MILITARY TECHNOLOGY
Activities of the 1st International Laser Science Conference
[AD-A173080] N87-14699
MILKY WAY GALAXY
Milky Way halo gas kinematics N87-15088
IRAS observations of giant molecular clouds in the Milky Way N87-15089
The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093
MILLING (MACHINING)
Tools for high velocity surface milling of steels
[CETIM-106030] N87-14710
MINERAL DEPOSITS
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797
MINERAL EXPLORATION
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797
MINERALS
Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods
[JUEL-CONF-55] N87-14450
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457
MINIMAX TECHNIQUE
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875
MIRRORS
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985
Evaluation of low density mirror blanks for space observatories
[SIRA-A/7123/00] N87-14987
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993
Microprocessor controlled optical measuring system for large mirror modules
[ESA-TT-984] N87-14995
MIS (SEMICONDUCTORS)
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
MISSILE CONTROL
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899
MISSILE DEFENSE
Strategic defense initiative and the prospects for international cooperation in space
[DE86-016153] N87-15029
MISSILES
A method for governing spacecraft evasive maneuvering
[AD-A170696] N87-14415
MISSION PLANNING
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138
MODELS
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647
Finite element modeling of electromagnetic propagation in composite structures
[NASA-TM-88916] N87-14956
Chemical evolution in spiral and irregular galaxies N87-15097
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146
MOIRE INTERFEROMETRY
Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494
MOISTURE
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
MOISTURE CONTENT
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834
MOLDS
Numerical calculations of extrusion by conical molds
[ETN-87-98700] N87-14748
MOLECULAR BEAM EPITAXY
Novel Si-based materials and device structures by molecular beam epitaxy
[AD-A170061] N87-15009
Development of a planar heterojunction bipolar transistor for very high speed logic
[AD-A170063] N87-15010
MOLECULAR CHAINS
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
MOLECULAR CLOUDS
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
Far-infrared investigation of the Taurus star-forming region using the IRAS database N87-15044
MM and subMM molecular line observations of the southwest lobe of L1551: Evidence of a shell structure N87-15045
High resolution observations of the L1551 bipolar outflow N87-15046
A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4' resolution N87-15047
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
Pervasive small-scale structure in molecular clouds N87-15055
HC3N maps of OMC1 N87-15056
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
Filamentary structure in the Orion molecular cloud N87-15058
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
Near-infrared observations of IRAS sources in and near dense cores N87-15061
The bird: A pressure-confined explosion in the interstellar medium N87-15062
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064
Jeans criterion in a turbulent medium N87-15065
Supershells and propagating star formation N87-15067
Size-density relations in dark clouds: Non-LTE effects N87-15068
CO near the Pleiades: Encounter of a star cluster with a small molecular cloud N87-15071
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
The molecular gas in the supernova remnant IC443 N87-15080
Observational discrimination between modes of shock propagation in interstellar clouds: Predictions of CH+ and SH+ column densities in diffuse clouds N87-15081
A CS J = 2 1 survey of the galactic center region N87-15082
Aperture synthesis observations of the molecular ring in the galactic center N87-15083
Cold atomic hydrogen in the inner galaxy N87-15085
The molecular content of the nearby galaxy from IRAS and HI observations N87-15087
IRAS observations of giant molecular clouds in the Milky Way N87-15089
The velocity dispersion of the giant molecule clouds: A viscous origin N87-15091
Unusual relative strengths of the diffuse interstellar bands in some interstellar dust clouds N87-15105
Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106
Some recent infrared spectroscopy of interstellar processes N87-15107
Depletions and extinction curves for lines of sight through the outer edges of truly dense molecular clouds N87-15110
The organic component of interstellar grains N87-15114
Translucent molecular clouds: Theory and observations N87-15117
Do large rate coefficients for ion-polar neutral reactions have a serious effect on chemical models of dense clouds? N87-15118
Studies of interstellar vibrationally-excited molecules N87-15119
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126
Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127
MOLECULAR DIFFUSION
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
MOLECULAR ELECTRONICS
New detector concepts — silicon radiation detectors
[MPE-PAE/EXP-E1-164] N87-14683
MOLECULAR EXCITATION
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne
[MPIS-2/1986] N87-14475
Studies of interstellar vibrationally-excited molecules N87-15119
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
MOLECULAR GASES
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
Molecular hydrogen in the young starburst in NGC 253 N87-15096
MOLECULAR OSCILLATIONS
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796
MOLECULAR RELAXATION
Relaxation of vibrational degrees of freedom N87-14335
MOLECULAR ROTATION
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne
[MPIS-2/1986] N87-14475
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120
MOLECULAR SPECTRA
MM and subMM molecular line observations of the southwest lobe of L1551: Evidence of a shell structure N87-15045
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
MOLECULAR STRUCTURE
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
Polymers in mechanochemical systems: Structure-property requirements
[DE86-014308] N87-14530
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963
MOLECULES
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962

MOLYBDENUM
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740

MOMENTUM THEORY
SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide
[NLR-TR-84128-U] N87-14266

MOMENTUM TRANSFER
Field study of wind through and over a forest edge
[AD-A169491] N87-14809

MONITORS
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832

MONOMERS
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433

MONOTONE FUNCTIONS
Multigrid solution of monotone second-order discretizations of hyperbolic conservation laws
[CWI-NM-R8611] N87-14955

MONTE CARLO METHOD
Frequency response functions of a nonlinear system
[DE86-016103] N87-14742
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944

MOON
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140

MORPHOLOGY
Pervasive small-scale structure in molecular clouds N87-15055
HC3N maps of OMC1 N87-15056
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
Filamentary structure in the Orion molecular cloud N87-15058
The bird: A pressure-confined explosion in the interstellar medium N87-15062
The possible existence of Interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099
Infrared studies of supernova remnants with the IRAS N87-15104
Geological-morphological description of the Ishtar Terra (photomap of the Venusian surface sheet B-5)
[NASA-TM-86497] N87-15143
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145

MOTION PERCEPTION
Applications of computer-graphics animation for motion-perception research
[NASA-TM-88335] N87-14845

MOTION PICTURES
Progress in holographic cinematography
[ISL-CO-243/85] N87-14680

MOTION SIMULATION
Applications of computer-graphics animation for motion-perception research
[NASA-TM-88335] N87-14845

MOTION STABILITY
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717

MULTIMODE RESONATORS
Resonator internal absorption and nonlinear dynamics of multimode laser systems
[MPE-197] N87-14684
Resonator internal absorption N87-14685
Dynamics of multimode lasers N87-14686

MULTIPLE ACCESS
Performance evaluation and control of distributed computer communication networks
[AD-A170610] N87-14579

MULTIPLEXING
Wavelength-multiplexed imaging techniques using optical fibers
[DE86-013028] N87-14986

MULTIPROCESSING (COMPUTERS)
Techniques to achieve high-speed computations in supercomputers N87-14250
Distributed control in computer networks and cross sections of colored multidimensional bodies
[CWI-CS-R8611] N87-14906
Aspects of the Amsterdam multiprocessor PROLOG system
[FVI-86-09] N87-14907

MULTISTAGE ROCKET VEHICLES
Winged space transporters: The problem of the number of stages — reusable launch vehicles
[ETN-87-98863] N87-14367

MULTIVARIATE STATISTICAL ANALYSIS
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14933
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942
Model for describing probability distributions in chains of events
[FOA-C-20619-2.6(2.7)] N87-14947

MUSCULAR STRENGTH
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836

N

NACELLES
Three-dimensional potential flow simulations for transonic inlets N87-14255

NARROWBAND
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084

NASA PROGRAMS
Report of the National Commission on Space
[S-HRG-99-954] N87-15028

NASA SPACE PROGRAMS
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138

NATIONS
Composition of the WMO
[WMO/OMM-5] N87-14820

NAVIER-STOKES EQUATION
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
Numerical simulation of an aircraft icing N87-14248
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Computational study of flow in curved pipes with circular-section N87-14264
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Transonic aileron computation in comparison to wind tunnel test N87-14273
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277
A verification of unsteady Navier-Stokes solutions around oscillating airfoils
[NASA-TM-88341] N87-14279
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
A numerical study of incompressible juncture flows
[NASA-TM-88319] N87-14644
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647

NAVIGATION AIDS
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695

NAVIGATION INSTRUMENTS
Balloon instrumentation engineering and development
[AD-A170225] N87-14678

NAVY
DOD (Department of Defense) acquisition: Case study of the Navy V-22 OSPREY Joint Vertical Lift Aircraft Program
[PB86-231388] N87-14315

NEAR FIELDS
Nonlinear wave propagation study
[AD-A170201] N87-14572

NEAR INFRARED RADIATION
Near-infrared observations of IRAS sources in and near dense cores N87-15061
Near-infrared spectroscopy of planetary nebulae: How strong is the H2 emission? N87-15074

NEBULAE
Models of polarized infrared emission from bipolar nebulae N87-15050
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069
Turbulence in HII regions N87-15070
Optical observations of very low ionization HII regions in the large Magellanic cloud N87-15072

NEGATIVE IONS
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14965
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967

NEODYMIUM LASERS
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691

NETWORK ANALYSIS
Systolic networks for the solution of linear problems
[ETN-87-98589] N87-14909

NETWORK CONTROL
Distributed control in computer networks and cross sections of colored multidimensional bodies
[CWI-CS-R8611] N87-14906

NEUMANN PROBLEM
Interaction of diffusion and boundary conditions
[AD-A170217] N87-14922

NEUROLOGY
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

NEUTRAL GASES
Neutral hydrogen cloud distances and the strength of the interstellar magnetic field N87-15086
Do large rate coefficients for ion-polar neutral reactions have a serious effect on chemical models of dense clouds? N87-15118

NEUTRON ACTIVATION ANALYSIS
A comparison of trace element analysis of whole coal by INAA and XRFS — instrument neutron activation analysis (INAA); X-ray fluorescence spectroscopy (XRFS) N87-14460

NEUTRON DIFFRACTION
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757

NEUTRON IRRADIATION
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503

NEUTRON STARS
Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs
[DE86-016168] N87-15135
Optically thin winds from neutron stars
[MPE-PREPRINT-50] N87-15154
The 35 day cycle of Her X-1: Quality of the clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155

NEUTRONS
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157

NICKEL
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511

NICKEL ALLOYS
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482

The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-88840] N87-14488
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495
A study of fatigue crack propagation in powder metallurgy hot isotatically pressed nickel-base alloy
[AD-A173211] N87-14497
Testing of high alloy steels for new hydrometallurgical processes and chemical plants
[BMFT-FB-T-86-055] N87-14506

NICKEL CADMIUM BATTERIES
Nicad battery packages
[AD-A170140] N87-14598

NICKEL OXIDES
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021

NIGHT
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808

NIOBIUM
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511

NITRIC OXIDE
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784

NITROGEN DIOXIDE
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784

NITROGEN OXIDES
Determination of the technical degradation of nitrogen oxides in the atmosphere
[BPT-3/86] N87-14785

NITROGEN PLASMA
Methods of plasma excitation
[AD-A170347] N87-15002

NITROUS OXIDES
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14768

NOISE GENERATORS
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959

NOISE INTENSITY
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973

NOISE MEASUREMENT
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
Noise certification and noise sensitivity studies on the BO-105 helicopter
[DFVLR-MITT-86-13] N87-14958
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959

NOISE POLLUTION
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
Noise disturbance at night near Heathrow and Gatwick airports: 1984 check study — London airports
[DR-8513] N87-14781
CEC joint study of community response to aircraft noise 1984: Main report. The influence of residual noise on disturbance from aircraft noise — Commission of the European Communities (CEC)
[DR-8601] N87-14782

NOISE PREDICTION
High-speed propeller noise predictions: Effects of boundary conditions used in blade loading calculations
[NASA-TM-88913] N87-14957

NOISE PROPAGATION
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655

NOISE REDUCTION
A noise reduction system for video signals with a low signal to noise ratio
[ETN-86-98720] N87-14614
Pulse amplifier with high common-mode rejection
[DIGEL-70] N87-14615
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959

NONAQUEOUS ELECTROLYTES
Non-aqueous primary cell
[AD-D012428] N87-14599

NONDESTRUCTIVE TESTS
Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures — aircraft structures
[DFVLR-MITT-86-09] N87-14437
Nondestructive tests of Carbon Fiber Reinforced Plastics (CFRP) in the framework of damage mechanics investigations N87-14438
Acoustic emission frequency discrimination
[NASA-CASE-MSC-20467-1] N87-14676
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720
Results of the tests carried out to study the physical parameters affecting the ultrasonic inspection made by transmission under water jet (SIRO), part 1
[I-114/85-PT-1] N87-14723
Results of the tests carried out to study the physical parameters affecting ultrasonic inspection made by transmission under water jets (SIRO), part 2
[I-126/85-PT-2] N87-14724
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741

NONEQUILIBRIUM FLOW
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916

NONEQUILIBRIUM THERMODYNAMICS
Discharges of saturated liquefied gases from pressure vessels N87-14545

NONLINEAR EQUATIONS
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916

NONLINEAR FILTERS
Measurement of parameters for nonlinear object-size filters in images
[ETN-87-98694] N87-14932

NONLINEAR SYSTEMS
Resonator internal absorption and nonlinear dynamics of multimode laser systems
[MPE-197] N87-14684
Frequency response functions of a nonlinear system
[DE86-016103] N87-14742
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924

NONLINEARITY
Compressible flow analysis in turbomachinery N87-14256
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
Nonlinear wave propagation study
[AD-A170201] N87-14572
Preliminary consideration on robustness of nonlinear discrete-time regulators
[INPE-4015-RPE/520] N87-14917

NONPARAMETRIC STATISTICS
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934
Stochastic convexity and its applications
[AD-A170112] N87-14939

NORMAL DENSITY FUNCTIONS
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944

NORMALIZING (HEAT TREATMENT)
Hot forming of thick plates
[CETIM-13-J-122] N87-14505

NORMALIZING (STATISTICS)
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942

NOTCH SENSITIVITY
Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494

NOTCH TESTS
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751

NOZZLE DESIGN
Extendable nozzle for the HM60 rocket engine — Ariane 5 N87-14398
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424

NOZZLE EFFICIENCY
Extendable nozzle for the HM60 rocket engine — Ariane 5 N87-14398

NOZZLE FLOW
An easily vectorizable numerical solution of the Euler equations N87-14258
Shock oscillations in transonic nozzle flows
[MPIS-7/1986] N87-14294
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14965

NOZZLE GEOMETRY
Extendable nozzle for the HM60 rocket engine — Ariane 5 N87-14398
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
Results of the tests carried out to study the physical parameters affecting ultrasonic inspection made by transmission under water jets (SIRO), part 2
[I-126/85-PT-2] N87-14724

NUCLEAR FUEL REPROCESSING
Remote operation and maintenance demonstration facility at the Oak Ridge National Laboratory
[DE86-012621] N87-14706

NUCLEAR MAGNETIC RESONANCE
Polymers in mechanochemical systems: Structure-property requirements
[DE86-014308] N87-14530

NUCLEAR POWER PLANTS
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14658

NUCLEAR REACTIONS
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503

NUMERICAL ANALYSIS
Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics
[NAL-SP-5] N87-14247
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944
Stark ladder density of states in a finite crystal
[DE86-702906] N87-15015

NUMERICAL CONTROL
Direct numerical control in grid generation N87-14270
A computer interface for digital control of a dc power source, appendix E N87-14626
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709

NUMERICAL DIFFERENTIATION
NUMVEC FORTRAN library manual. Chapter: Parabolic Partial Differential Equations (PDEs). Routine: Backward differentiation multigrid (BDMG)
[CWI-NM-R8610] N87-14927

NUMERICAL FLOW VISUALIZATION
Computational study of three-dimensional wake structure N87-14272

NUMERICAL STABILITY
Stabilization of the Lax-Wendroff methods and a generalized one-step Runge-Kutta method for hyperbolic initial-value problems
[CWI-NM-R8613] N87-14929

NUMERICAL WEATHER FORECASTING
Results from prediction of cloudiness with a limited area model
[DM-48] N87-14821

O

OBSERVABILITY (SYSTEMS)
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871

OCCULTATION
A study of the utility of solar occultation measurements for determination of atmospheric composition — spaceborne observation
[ESA-CR(P)-2232] N87-14798

OCEAN BOTTOM
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826

OCEAN CURRENTS
Numerical simulations of the circulation of the eastern Mediterranean
[AD-A170219] N87-14825
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829

OCEAN DATA ACQUISITIONS SYSTEMS
International list of selected, supplementary and auxiliary ships — Global Observing System
[WMO/OMM-47-ED-86] N87-14819
Methods of remote evaluation of chlorophyll concentration in the sea
[DRIC-T-7652] N87-14824

OCEAN MODELS
Numerical simulations of the circulation of the eastern Mediterranean
[AD-A170219] N87-14825
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829

OCEANOGRAPHY
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

OGIVES
Compressibility effects on flows around simple components N87-14642

OMEGA NAVIGATION SYSTEM
Balloon instrumentation engineering and development
[AD-A170225] N87-14878

OMNIDIRECTIONAL ANTENNAS
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170689] N87-14312

ONBOARD DATA PROCESSING
Packet telemetry — Spacecraft data
[MATRA-RF/176/0898-ISSUE-1-REV.] N87-14371
Assessment of data handling configuration for onboard operating system definition, phase 2/3
[MATRA-RF/139/1096] N87-14867
CADISS: An onboard system for compression and decompression of imagery sensor signals
[NLR-MP-85045-U] N87-14868

OPERATING SYSTEMS (COMPUTERS)
Database oriented UNIX operating environment and its application N87-14253
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330
Assessment of data handling configuration for onboard operating system definition, phase 2/3
[MATRA-RF/139/1096] N87-14867
MORE operating system: A message oriented resource environment
[DE86-013932] N87-14887
Portable operating systems for network computers: Distributed operating systems support for group communications
[AD-A170113] N87-14905

OPERATIONAL HAZARDS
Stratification phenomena and associated hazards N87-14549
Steam explosions and associated hazards N87-14550
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operaters are being subjected
[MOD-103/86] N87-14783

OPERATOR PERFORMANCE
A model of typing performance with respect to mental load factors — computer operators
[DRIC-T-7770] N87-14844

OPERATORS (MATHEMATICS)
Limiting behavior of linearly damped hyperbolic equations
[AD-A170161] N87-14920

OPERATORS (PERSONNEL)
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837

OPTICAL COMMUNICATION
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584
Laser physics and laser techniques
[AD-A171949] N87-14697

OPTICAL EQUIPMENT
High-temperature, high-pressure optical cell
[NASA-CASE-MFS-26000-1] N87-14971
Nonlinear pixel replacement estimation
[AD-A168682] N87-14973
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984

OPTICAL MEASUREMENT
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993

OPTICAL MEASURING INSTRUMENTS
Vibration-free Raman Doppler velocimeter
[NASA-CASE-LAR-13268-1] N87-14669
A low-cost optical data acquisition system for vibration measurement
[NASA-TM-88907] N87-14730
Microprocessor controlled optical measuring system for large mirror modules
[ESA-TT-964] N87-14995

OPTICAL MICROSCOPES
Further developments of the Solid State Automated Microscope (SSAM)
[ETN-87-98693] N87-14991

OPTICAL POLARIZATION
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981

OPTICAL PROPERTIES
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
Laser physics and laser techniques
[AD-A171949] N87-14697
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979
Investigation of the optical properties of solar cells
[BMFT-FB-T-86-008] N87-14989

OPTICAL PUMPING
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974

OPTICAL REFLECTION
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441

OPTICAL WAVEGUIDES
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526

OPTIMIZATION
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-98591] N87-14904
Systolic networks for the solution of linear problems
[ETN-87-98589] N87-14909
Model reduction of sampled data systems
[OUEL-1625/86] N87-14930
Optimal allocation of multistate components
[AD-A170081] N87-14937

ORBIT CALCULATION
Nonsingular parametric expressions for orbit propagation by theoretical estimation of parameters
[INPE-4024-TDL/241] N87-14360
Orbit calculation for artificial Earth satellites
[GKSS-86/E/21] N87-14365

ORBIT PERTURBATION
Constrained normalization of Hamiltonian systems and perturbed Keplerian motion
[CWI-PM-R8603] N87-14954
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041

ORBITAL MANEUVERING VEHICLES
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

ORBITAL MANEUVERS
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421

ORBITAL MECHANICS
Stationkeeping of libration point orbits, executive summary
[ESA-CR(P)-2272] N87-14363
Alternative mathematical programming formulations for FSS synthesis
[NASA-CR-180030] N87-14872
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041

ORBITAL RENDEZVOUS
Rendezvous and docking (RVD) guidance simulation program, rider 2
[MATRA-EPT/DT/VT068/012] N87-14359
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370

ORBITAL SERVICING
Proceedings of the SMRM Degradation Study Workshop
[NASA-TM-89274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
Failure analysis and performance evaluation of NASA inertial reference unit (DRIRU 2) after 50 months of orbital operation N87-14378
Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382

ORBITAL SPACE STATIONS
Post-Challenger assessment of space shuttle flight rates and utilization
[NASA-CR-180105] N87-14368

ORGANIC COMPOUNDS
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520

ORGANIZATIONS
Organizations as information processing systems
[AD-A173362] N87-15026

ORGANOMETALLIC POLYMERS
Polymer precursors for ceramic matrix composites
[NASA-CR-179562] N87-14434

ORION CONSTELLATION
HC3N maps of OMC1 N87-15056
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
Filamentary structure in the Orion molecular cloud N87-15058

ORION NEBULA
Filamentary structure in the Orion molecular cloud N87-15058

OROGRAPHY
Forcing mechanisms of mountain-valley circulations in the Inn-Valley (Alps)
[DFVLR-FB-86-26] N87-14802

ORTHOGONAL FUNCTIONS
Intertwining functions in compact Lie groups and multivariable orthogonal polynomials
[CWI-PM-R8601] N87-14952

OSCILLATING FLOW
A verification of unsteady Navier-Stokes solutions around oscillating airfoils
[NASA-TM-88341] N87-14279

OSCILLATIONS
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-98436] N87-14287
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753

OSCILLATORS
Low phase noise oscillator
[NASA-CASE-GSC-13018-1] N87-14596
Reduced tolerance imaging I
[AD-A170932] N87-14882

OXIDATION
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496

FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
OXIDATION RESISTANCE
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig
[NASA-TM-88840] N87-14488
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
Advanced high temperature coating systems beyond current state of the art systems
[AD-A170192] N87-14523
OXIDATION-REDUCTION REACTIONS
Electrochemical behavior of a titanium electrode in hydrazine solutions
[NASA-TM-88538] N87-14464
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
OXIDIZERS
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
OXYGEN
Oxygen index: An approximate value for the evaluation of combustion characteristics
[NASA-TM-88492] N87-14465
OXYGEN ANALYZERS
Effect of the raw material composition of fabrics on the Limiting Oxygen Index (LOI)
[NASA-TM-88483] N87-14463
OXYGEN ATOMS
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Teflon, Kapton surface and bulk effects N87-14390
Analysis of normal and transparent silver Teflon N87-14391
Degradation studies of SMRM Teflon N87-14392
Solar maximum thermal surface assessment N87-14393
OXYGEN CONSUMPTION
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836

P

PACKAGING
Nicad battery packages
[AD-A170140] N87-14598
PACKET SWITCHING
A user-oriented performance index for packet switched networks
[AD-A168903] N87-14570
PACKET TRANSMISSION
Packet telemetry — Spacecraft data
[MATRA-RF/178/0898-ISSUE-1-REV.] N87-14371
PACKETS (COMMUNICATION)
A user-oriented performance index for packet switched networks
[AD-A168903] N87-14570
PALLADIUM COMPOUNDS
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477
PANEL METHOD (FLUID DYNAMICS)
Development of supersonic computational aerodynamic program using panel method N87-14261
Numerical simulation of vortical flow N87-14640
A direct method for evaluating the disturbance fields of moving singularities at subsonic speeds in compressible media
[ESA-TT-977] N87-14667
PANSPERMIA
Organic grains in comets
[PREPRINT-122] N87-15137
PARABOLIC DIFFERENTIAL EQUATIONS
Interaction of diffusion and boundary conditions
[AD-A170217] N87-14922
NUMVEC FORTRAN library manual. Chapter: Parabolic Partial Differential Equations (PDEs). Routine: Backward differentiation multigrid (BDMG)
[CWI-NM-R8610] N87-14927
PARALLEL FLOW
Investigations of the wake in a flow parallel to plates with blunt trailing edges
[MPIS-3/1986] N87-14293
PARALLEL PROCESSING (COMPUTERS)
Techniques to achieve high-speed computations in supercomputers N87-14250
VP series hardware N87-14251
Fault tolerance in parallel architectures
[AD-A170245] N87-14864
The complexity of parallel algorithms
[AD-A172445] N87-14885
User's introductory guide (HM-256)
[DE86-013002] N87-14886
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-98591] N87-14904
Location of the communication process network described in FP2 on a graph structure in order to implement the parallel processing of that language
[RR-606-IMAG-49-LIFIA-I] N87-14914
Parallel matrix computations
[AD-A170699] N87-14923
PARALLEL PROGRAMMING
Aspects of the Amsterdam multiprocessor PROLOG system
[FVI-86-09] N87-14907
Location of the communication process network described in FP2 on a graph structure in order to implement the parallel processing of that language
[RR-606-IMAG-49-LIFIA-I] N87-14914
PARAMETER IDENTIFICATION
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
Results of the tests carried out to study the physical parameters affecting the ultrasonic inspection made by transmission under water jet (SIRO), part 1
[I-114/85-PT-1] N87-14723
Parameter estimation problems for distributed systems using a multigrid method
[NASA-CR-178194] N87-14862
Reduced complexity set-point following in self-tuning control
[OUEL-1626/86] N87-14913
PARAMETERIZATION
Nonsingular parametric expressions for orbit propagation by theoretical estimation of parameters
[INPE-4024-TDL/241] N87-14360
Parameterization of overwater horizontal wind variability
[AD-A169331] N87-14807
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 — X-ray burster
[MPE-PREPRINT-57] N87-15156
PARASITES
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
PARTIAL DIFFERENTIAL EQUATIONS
Compressible flow analysis in turbomachinary N87-14256
Solution of elliptic partial differential equations by fast Poisson solvers using a local relaxation factor. 2: Two-step method
[NASA-TP-2530] N87-14918
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations
[AD-A170187] N87-14921
PARTICLE BEAMS
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
PARTICLE INTERACTIONS
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Superunification, phase transitions and cosmology
[DE86-702955] N87-15134
PARTICLE THEORY
Cosmic superstrings and related topics
[DE86-702738] N87-15133
PARTICLES
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
PASSENGER AIRCRAFT
Human factors in accidents due to controlled flight into the ground
[CAA-PAPER-85015] N87-14298
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
PASSENGERS
Helicopter passenger weigh survey, conducted at Aberdeen Airport, November 1984
[CAA-PAPER-85005] N87-14853
PATENT APPLICATIONS
Spacecraft subsystem support structure
[AD-D012437] N87-14576
Quantum well electron barrier diode
[AD-D012432] N87-14600
Optical Gaussian convolvers
[AD-D012438] N87-14976
PATTERN RECOGNITION
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
PAVEMENTS
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554
PAYLOAD MASS RATIO
Development of a technology for increasing payload of existing aircraft (NEW 2)
[BMFT-FB-W-86-007] N87-14328
PAYLOADS
Magnitude equivalence of random loads and superposition with transient excitations — spacecraft payloads
[TR-5.338] N87-14418
PEELING
The continuous production of stir cast material
[ETN-87-98701] N87-14557
PERFORMANCE PREDICTION
SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide
[NLR-TR-84126-U] N87-14288
PERFORMANCE TESTS
Heat pipe experiment on SPAS 01 N87-14411
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513
Nicad battery packages
[AD-A170140] N87-14598
Laboratory tests of the sensors of the Steinhell-Lear Siegler Strapdown Measurement Unit model 1903-SB for model attitude measurements in a wind tunnel
[DFVLR-MITT-86-15] N87-14682
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703
PERIODIC VARIATIONS
The 35 day cycle of Her X-1: Quality of the clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155
PERIODICALS
On deliberate misreferencing as a tool of science policy
[PREPRINT-125] N87-15027
PERIPHERAL VISION
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
PERSONNEL
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857
Compendium of research
[AD-A170356] N87-15024
PERSONNEL DEVELOPMENT
Compendium of research
[AD-A170356] N87-15024
PERSONNEL MANAGEMENT
Compendium of research
[AD-A170356] N87-15024

PERSONNEL SELECTION
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
PERTURBATION
Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet
[NASA-TM-88922] N87-14283
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals --- in helicopters
[ESA-TT-979] N87-14352
Frozen orbits-near constant or beneficially varying orbital parameters
[AD-A170675] N87-14362
A direct method for evaluating the disturbance fields of moving singularities at subsonic speeds in compressible media
[ESA-TT-977] N87-14667
Stability of a shear model in which perturbations move with the mean local flow
[PB86-232469] N87-14805
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
PERTURBATION THEORY
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
Robust stability under additive perturbations: An implicit assumption --- control stability
[OUEL-1622/86] N87-14912
PHASE CONTRAST
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466
PHASE CONTROL
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974
PHASE DETECTORS
Double reference pulsed phase locked loop
[NASA-CASE-LAR-13310-1] N87-14559
PHASE ERROR
Phase lag analysis of implicit Runge-Kutta methods
[CWI-NM-R8612] N87-14928
PHASE LOCKED SYSTEMS
Double reference pulsed phase locked loop
[NASA-CASE-LAR-13310-1] N87-14559
PHASE SHIFT
Double reference pulsed phase locked loop
[NASA-CASE-LAR-13310-1] N87-14559
PHASE TRANSFORMATIONS
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532
Formation and dynamics of aerosols N87-14546
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
PHASED ARRAYS
A design concept for an MMIC microstrip phased array
[NASA-TM-88834] N87-14569
Phased Array Laser System (PALS)
[AD-A169635] N87-14689
PHOBOS
Phobos and Deimos: Satellites of Mars
[NASA-TM-88016] N87-15142
PHONONS
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961
Spectroscopy of the phonons on noble gas surfaces using helium atomic beam scattering
[MPIS-1/1986] N87-14968
PHOSPHATES
Analyses of the phosphate standard of the Egyptian Nuclear Materials Corporation (phosphate 1) N87-14459
The performance of zinc phosphate two-pack epoxy primers
[MQAD-TP-917] N87-14514
PHOTOACOUSTIC SPECTROSCOPY
Laser-photoacoustic spectroscopy of air pollutants
[M-19] N87-14787
PHOTOCATHODES
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963
PHOTODECOMPOSITION
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
PHOTODIODES
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963
PHOTODISSOCIATION
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
A precision laser spectrometer system
[AD-A170226] N87-14692
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962
PHOTOGRAMMETRY
An extended mathematical model of aerotriangulation for highly precise point determination
[SER-C-316] N87-14762
Construction of a digital height model based on simple finite elements --- photogrammetry
[SER-C-315] N87-14763
PHOTOGRAPHS
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973
PHOTOIONIZATION
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
PHOTOLYSIS
A precision laser spectrometer system
[AD-A170226] N87-14692
PHOTOMETRY
Calibration of ETS videotapes
[AD-A168888] N87-14677
PHOTOMICROGRAPHY
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594
PHOTONICS
High bandwidth analog applications of photonics: Present capabilities and future possibilities
[DE86-014999] N87-14582
PHOTONS
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
PHOTOSPHERE
An atlas of photospheric magnetic field observations and computed coronal magnetic fields: 1976 - 1985
[NASA-CR-180019] N87-15151
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153
PHOTOSYNTHESIS
Photobiological hydrogen production in green algae and photosynthetic bacteria
[DE86-015918] N87-14833
PHOTOVOLTAIC CONVERSION
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
PHOTOVOLTAIC EFFECT
Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy
[INPE-3992-PRE/992] N87-15005
PHYSICAL EXERCISE
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
PHYSICAL FITNESS
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
PHYSICAL OPTICS
Scattering by complicated structures: Calculation of the radar properties of metallic targets by means of physical optics
[ESA-TT-946] N87-14593
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978
PHYSIOLOGICAL FACTORS
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
PHYSIOLOGICAL RESPONSES
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
PHYSIOLOGICAL TESTS
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
PICTURE TUBES
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14613
PILOT ERROR
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851
PILOT PERFORMANCE
Human factors in accidents due to controlled flight into the ground
[CAA-PAPER-85015] N87-14298
On the pilot's behavior of detecting a system parameter change
[NASA-TM-88536] N87-14846
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
Visual sensitivities and discriminations and their roles in aviation
[AD-A170418] N87-14849
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851
PILOT SELECTION
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852
PILOT TRAINING
The simulator: The perfect illusion --- flight simulator
[FACHTHEMEN-9] N87-14354
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851
PIPE FLOW
Computational study of flow in curved pipes with circular-section N87-14264
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959
PIPELINING (COMPUTERS)
Techniques to achieve high-speed computations in supercomputers N87-14250
VP series hardware N87-14251
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908
PIPES (TUBES)
Propagation of sound waves in tubes of noncircular cross section
[NASA-TP-2601] N87-14284
In situ repair of a failed compression fitting
[DE86-013682] N87-14707
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing
[DE86-013681] N87-14719
Tearing of circumferential cracks in pipes loaded by bending
[AD-A170429] N87-14734
PISTON ENGINES
The deduction of bearing forces in rotating machinery --- ship machinery
[BR99658] N87-14372
PISTONS
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14661
PITCHING MOMENTS
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282
PITTING
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511

PIXELS
Nonlinear pixel replacement estimation
[AD-A166882] N87-14973
PLANETARY ATMOSPHERES
Heterodyne spectroscopy of planetary and stellar atmospheres at a wavelength of 11 micrometers
[MPE-198] N87-15040
The planets of the Solar System
[NASA-TM-88015] N87-15148
PLANETARY EVOLUTION
The planets of the Solar System
[NASA-TM-88015] N87-15148
PLANETARY MAPPING
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21)
[NASA-TM-88494] N87-15139
PLANETARY NEBULAE
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
Near-infrared spectroscopy of planetary nebulae: How strong is the H2 emission? N87-15074
Infrared spectra of WC10 planetary nebulae nuclei N87-15075
Planetary nebulae and the interstellar medium N87-15076
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077
Spectral characteristics of dust in carbon rich objects N87-15113
PLANETARY TEMPERATURE
The planets of the Solar System
[NASA-TM-88015] N87-15148
PLANETOLOGY
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140
Space research in Belgium
[ISSN-0772-9804] N87-15159
PLANNING
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772
PLASMA ELECTRODES
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
PLASMA HEATING
Antenna optimization for Alfven wave heating
[IPP-4/228] N87-14592
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
PLASMA INTERACTIONS
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003
PLASMA JETS
A stabilized dc plasma and an advanced spectrochemical analysis system N87-14458
PLASMA LAYERS
Double layers and circuits in astrophysics
[NASA-CR-180018] N87-15136
PLASMA OSCILLATIONS
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
PLASMA PHYSICS
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
PLASMA SHEATHS
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
PLASMA TURBULENCE
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
Turbulence in HII regions N87-15070
PLASMA WAVES
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795
PLASMAS (PHYSICS)
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
Methods of plasma excitation
[AD-A170347] N87-15002
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
PLASTIC DEFORMATION
Parquet: Regions of areal plastic dislocations (on Venus)
[NASA-TM-88510] N87-15147
PLASTIC PROPERTIES
On contact problems of elasticity theory
[NASA-TM-88491] N87-14729
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects
[AD-A170644] N87-14736
Mixed mode 1 and 2 fully plastic crack growth
[AD-A170645] N87-14737
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738
PLASTICIZERS
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
PLASTICS
Oxygen index: An approximate value for the evaluation of combustion characteristics
[NASA-TM-88492] N87-14465
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739
PLATES (STRUCTURAL MEMBERS)
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756
PLOTTERS
Postexperimental plots with a HP 7550A plotter
[DE86-015501] N87-14866
PLUMES
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428
PNEUMATIC CIRCUITS
Investigation of the influence of the impact friction coefficient on pneumatic conveying (Friction Pressure Loss (FPL) 304)
[BMFT-FB-W-86-009] N87-14711
POINT SOURCES
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study
[NASA-CR-177900] N87-15150
POINTS (MATHEMATICS)
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
POISSON DENSITY FUNCTIONS
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934
POLAR COORDINATES
Models for the prediction of polar coordinates of lunar reflectors in the dynamic Earth-Moon system
[REPT-69] N87-14701
POLARIMETERS
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
POLARIZATION (CHARGE SEPARATION)
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
POLARIZATION (WAVES)
Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109
POLARIZED ELECTROMAGNETIC RADIATION
Models of polarized infrared emission from bipolar nebulae N87-15050
POLICIES
On deliberate misreferencing as a tool of science policy
[PREPRINT-125] N87-15027
POLLUTION CONTROL
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708
POLLUTION MONITORING
Laser-photoacoustic spectroscopy of air pollutants
[M-19] N87-14787
POLLUTION TRANSPORT
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784
Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
POLYCRYSTALS
Research activities of the National Institute for Materials Research, 1985
[DE86-702765] N87-14436
POLYESTER RESINS
Low contraction additives for polyester resins
[ETN-86-86563] N87-14535
POLYETHYLENES
Polymers in mechanochemical systems: Structure-property requirements
[DE86-014308] N87-14530
POLYIMIDES
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N87-14516
POLYMER CHEMISTRY
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
POLYMER PHYSICS
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
POLYMERIZATION
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
Polymer precursors for ceramic matrix composites
[NASA-CR-179562] N87-14434
The 5-(4-Ethynylphenoxy) isophthalic chloride
[NASA-CASE-LAR-13316-2] N87-14515
POLYNOMIALS
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
Intertwining functions in compact Lie groups and multivariable orthogonal polynomials
[CWI-PM-R8601] N87-14952
POPULATION THEORY
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
Stochastic convexity and its applications
[AD-A170112] N87-14939
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946
PORTABLE EQUIPMENT
Development of a portable precision landing system
[NASA-TM-88247] N87-14310
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
POSITION (LOCATION)
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
Underwater explosion modeling of an energy absorption system
[AD-A169880] N87-14646
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
POSTFLIGHT ANALYSIS
Proceedings of the SMRM Degradation Study Workshop
[NASA-TM-89274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
The Main Electronics Box (MEB) of the HAO coronagraph/polarimeter N87-14376
Radiation effects on selected electronics parts from the solar max satellite N87-14377
Failure analysis and performance evaluation of NASA inertial reference unit (DRIRU 2) after 50 months of orbital operation N87-14378

Analysis of DRIRU bearings and lubricant from solar max repair mission N87-14379
Postflight evaluation of the solar maximum spacecraft magnetometers N87-14380
Solar maximum mission post flight performance analyses of standard reaction wheels S/N's 102, 103, 104 and 105 N87-14381
Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382
Results of examination of materials from the solar maximum recovery mission N87-14383

POTASSIUM BROMIDES
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

POTENTIAL FLOW
Compressible flow analysis in turbomachinery N87-14256
Development of supersonic computational aerodynamic program using panel method N87-14261
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278

POWDER METALLURGY
Materials science in Europe
[AD-A170214] N87-14435
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495
A study of fatigue crack propagation in powder metallurgy hot isotatically pressed nickel-base alloy
[AD-A173211] N87-14497
Development of a suitable powder metal on iron base for general use in highly loaded slide bearings
[BMFT-FB-T-86-056] N87-14507

POWDERED ALUMINUM
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495

POWER EFFICIENCY
Adaptive TDMA as a means of trading power against bandwidth --- satellite transmission N87-14563

POWER LINES
Cables and fire hazards
[NASA-TM-88493] N87-14553

PRE-MAIN SEQUENCE STARS
Spectral evolution of young stellar objects N87-15066

PRECIPITATION (CHEMISTRY)
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels
[BLL-CE-TRANS-8252-(9022.09)] N87-14481
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823

PRECIPITATION (METEOROLOGY)
Binary time series with reward. Application to climatology modeling
[ETN-87-98588] N87-14950

PRECIPITATION HARDENING
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498

PREDICTION ANALYSIS TECHNIQUES
Effects of boundary conditions in numerical experiments for turbulent flows N87-14265
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278
Nonlinear dynamic response of composite rotor blades
[AD-A173089] N87-14321
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
Prediction methods for the calculation of flow fields around reentry vehicles N87-14395
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417
Magnitude equivalence of random loads and superposition with transient excitations --- spacecraft payloads
[TR-5.338] N87-14418
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Analysis of conduction from a heated cubical element to a plane conducting wall, appendix A N87-14622
Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate
[NLR-MP-85062-U] N87-14744
Time series prediction of hurricane landfall
[AD-A170742] N87-14815
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033

PREFORMS
Fiber reinforced ceramic material
[NASA-CASE-LEW-14392-1] N87-14517

PREIMPREGNATION
Elementary characterization of the AS4/2220.3 Hercules prepreg
[CEAT-M4-475-000] N87-14448
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535

PREMIXED FLAMES
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467

PRESSURE BREATHING
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840

PRESSURE EFFECTS
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703

PRESSURE MEASUREMENT
Measurement of pressure fluctuations on the wall of a turbulent combustion furnace
[ONERA-RTS-47/7104-EY] N87-14478
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
Device for quick changeover between wind tunnel force and pressure testing
[NASA-CASE-LAR-13512-1] N87-14675

PRESSURE OSCILLATIONS
Shock oscillations in transonic nozzle flows
[MPIS-7/1986] N87-14294

PRESSURE SENSORS
Electrothermal gas generator: Development and qualification of the control electronics
[BMFT-FB-W-86-006] N87-14611

PRESSURE VESSELS
Discharges of saturated liquefied gases from pressure vessels N87-14545
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733

PRIMARY BATTERIES
Non-aqueous primary cell
[AD-D012428] N87-14599

PRIMERS (COATINGS)
The performance of zinc phosphate two-pack epoxy primers
[MOAD-TP-917] N87-14514

PROBABILITY DISTRIBUTION FUNCTIONS
Model for describing probability distributions in chains of events
[FOA-C-20619-2.6(2.7)] N87-14947

PROBABILITY THEORY
A fast graphical goodness of fit test for time series models
[AD-A170094] N87-14919
Easily stated but hard statistical problems
[AD-A170057] N87-14935
Stochastic convexity and its applications
[AD-A170112] N87-14939
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941

PROBLEM SOLVING
Parameter estimation problems for distributed systems using a multigrid method
[NASA-CR-178194] N87-14862
The complexity of parallel algorithms
[AD-A172445] N87-14885
Solution of elliptic partial differential equations by fast Poisson solvers using a local relaxation factor. 2: Two-step method
[NASA-TP-2530] N87-14918
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924
Easily stated but hard statistical problems
[AD-A170057] N87-14935
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170830] N87-15025

PROCEDURES
A computer interface for digital control of a dc power source, appendix E N87-14626

PROCESS CONTROL (INDUSTRY)
The effect of process parameters on the internal quality of an aluminum die casting
[ETN-86-98703] N87-14556
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14858

PROCESS HEAT
Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452

PRODUCT DEVELOPMENT
Pulse amplifier with high common-mode rejection
[DIGEL-70] N87-14615
Computational fluid dynamics in engineering and education
[CFDU/86/6] N87-14658
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
BACON-52 single board controller
[DIGEL-68] N87-14869

PRODUCTION ENGINEERING
Production of aluminum-silicon carbide composites
[ETN-86-98696] N87-14446
Development of a copy-peeling machine for machining the surface of hot rolled square billets
[BMFT-FB-HA-86-004] N87-14555
The continuous production of stir cast material
[ETN-87-98701] N87-14557
Evaluation of methods for coordination of software technological tasks using examples of the Spacelab program and air surveillance program. Part 3: Experience report for a software project for air surveillance
[BMFT-FB-DV-86-005] N87-14898

PRODUCTIVITY
Compendium of research
[AD-A170356] N87-15024

PROGRAM VERIFICATION (COMPUTERS)
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878

PROGRAMMING LANGUAGES
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
MOS circuit models in network C
[AD-A169951] N87-14876
The cleaning person algorithm --- B programming language
[CWI-CS-R8610] N87-14889
A general object-centered database language (GODEL): A preliminary definition
[CWI-CS-R8615] N87-14892
Module algebra --- software engineering
[CWI-CS-R8617] N87-14894
Aspects of the Amsterdam multiprocessor PROLOG system
[FVI-86-09] N87-14907

PROJECT MANAGEMENT
DOD (Department of Defense) acquisition: Case study of the Navy V-22 OSPREY Joint Vertical Lift Aircraft Program
[PB86-231388] N87-14315

PROJECTILES
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647

PROPAGATION VELOCITY
Double reference pulsed phase locked loop
[NASA-CASE-LAR-13310-1] N87-14559

PROPELLANT TANKS
Preliminary results from the EMTE fuel slosh flight experiment --- STS-16 N87-14410

PROPELLANTS
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426

PROPELLERS
Aerodynamic characteristics of general aviation at high angle of attack with the propeller slipstream
[NASA-TM-88503] N87-14280
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282
SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide
[NLR-TR-84128-U] N87-14288
High-speed propeller noise predictions: Effects of boundary conditions used in blade loading calculations
[NASA-TM-88913] N87-14957

PROPULSION SYSTEM CONFIGURATIONS
Combined propulsion systems, aerothermodynamic processes and an evaluation study of propulsion components and systems N87-14345
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
Combined spacecraft propulsion systems
[ETN-87-98864] N87-14431

PROPULSION SYSTEM PERFORMANCE
Base pressure control for aerospace vehicles N87-14412
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430
Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170838] N87-14651

PROTECTIVE CLOTHING
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856
Development of a communication system compatible with chemical protective clothing and equipment
[NASA-CR-177040] N87-14861

PROTECTIVE COATINGS
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485
Ionic deposits
[CETIM-12-F-362] N87-14504
Advanced high temperature coating systems beyond current state of the art systems
[AD-A170192] N87-14523

PROTOSTARS
High resolution observations of the L1551 bipolar outflow N87-15046
A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4' resolution N87-15047
Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
Grain processes in massive star formation N87-15063
Spectral evolution of young stellar objects N87-15066
Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106

PROTOTYPES
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
Development of a communication system compatible with chemical protective clothing and equipment
[NASA-CR-177040] N87-14861

PSYCHOLOGICAL TESTS
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852

PSYCHOLOGY
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158

PSYCHOMOTOR PERFORMANCE
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851

PSYCHOPHYSIOLOGY
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838

PULMONARY FUNCTIONS
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840

PULSE DOPPLER RADAR
Derivation of the radar range equation for a pulse-Doppler radar with range and velocity gating and coherent and noncoherent pulse integration
[AD-A170354] N87-14573

PULSE GENERATORS
Pulse shaping with transmission lines
[DE86-013674] N87-14608

PULSE MODULATION
Pulse shaping with transmission lines
[DE86-013674] N87-14608
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
Pulsed MIG welding, text
[ETN-87-98699] N87-14716

PULSE POSITION MODULATION
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584

PULSED LASERS
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691
Laser physics and laser techniques
[AD-A171949] N87-14697
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013

PURITY
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521

PYROLYSIS
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539

Q

QUALITY CONTROL
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
The effect of process parameters on the internal quality of an aluminum die casting
[ETN-86-98703] N87-14556

QUANTUM CHROMODYNAMICS
Superunification, phase transitions and cosmology
[DE86-702955] N87-15134

QUANTUM EFFICIENCY
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036

QUANTUM ELECTRONICS
Quantum well electron barrier diode
[AD-D012432] N87-14600
Novel Si-based materials and device structures by molecular beam epitaxy
[AD-A170061] N87-15009

QUARTZ
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414

QUEUEING THEORY
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580
Queueing analysis of fault-tolerant computer systems
[AD-A170303] N87-14865
The power of the queue — computer storage models
[CWI-CS-R8612] N87-14890
Stochastic convexity and its applications
[AD-A170112] N87-14939

R

RADAR
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981

RADAR IMAGERY
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140

RADAR MAPS
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set — X-band SLAR
[CNES-85/187T/CT/DRT/TIT/RL] N87-14828

RADAR MEASUREMENT
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary
[ESA-CR(P)-2215] N87-14760

RADAR RANGE
Derivation of the radar range equation for a pulse-Doppler radar with range and velocity gating and coherent and noncoherent pulse integration
[AD-A170354] N87-14573

RADAR RECEIVERS
Development of a portable precision landing system
[NASA-TM-88247] N87-14310

RADAR SCATTERING
Scattering by complicated structures: Calculation of the radar properties of metallic targets by means of physical optics
[ESA-TT-946] N87-14593

RADAR TARGETS
Scattering by complicated structures: Calculation of the radar properties of metallic targets by means of physical optics
[ESA-TT-946] N87-14593

RADIAL VELOCITY
Turbulence in HII regions N87-15070
CO near the Pleiades: Encounter of a star cluster with a small molecular cloud N87-15071

RADIATION ABSORPTION
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578

RADIATION DAMAGE
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834

RADIATION DISTRIBUTION
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575

RADIATION DOSAGE
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835

RADIATION EFFECTS
Radiation effects on selected electronics parts from the solar max satellite N87-14377
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503
Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831
Effects of 60 Hz fields on human health parameters
[PB86-231297] N87-14835
Radiation effects in space
[DE86-013257] N87-14841

RADIATION HAZARDS
Stratification phenomena and associated hazards N87-14549
Steam explosions and associated hazards N87-14550
Radiation effects in space
[DE86-013257] N87-14841

RADIATION MEASUREMENT
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157

RADIATION PROTECTION
Radiation effects in space
[DE86-013257] N87-14841

RADIATION TOLERANCE
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14634
RADIATIVE HEAT TRANSFER
Radiation from an element in an array to its surroundings, appendix C N87-14624
RADIATIVE TRANSFER
Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170838] N87-14651
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149
RADIO ALTIMETERS
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary
[ESA-CR(P)-2215] N87-14769
RADIO ANTENNAS
A log - periodic HF antenna system
[AD-D012527] N87-14581
RADIO ASTRONOMY
Delay estimation in digital correlation interferometers with special consideration of the MK 2 system of the Max-Planck Institute of Radio Astronomy
[REPT-68] N87-15038
The X-ray and gamma-ray astronomy (including non-photon astronomy)
[MPE-PREPRINT-58] N87-15039
High resolution observations of the L1551 bipolar outflow N87-15046
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149
RADIO EMISSION
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060
The bird: A pressure-confined explosion in the interstellar medium N87-15062
RADIO INTERFEROMETERS
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766
Delay estimation in digital correlation interferometers with special consideration of the MK 2 system of the Max-Planck Institute of Radio Astronomy
[REPT-68] N87-15038
RADIO NAVIGATION
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
RADIOACTIVE WASTES
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829
RADIOACTIVITY
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157
RAILS
C-130/C-141 center vertical restraint
[AD-A170438] N87-14320
RAIN
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
RAMAN LASERS
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173086] N87-14698
RAMAN SPECTROSCOPY
Flame diagnosis using coherent anti-Stokes Raman scattering (CARS) N87-14336
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532
RANDOM LOADS
Magnitude equivalence of random loads and superposition with transient excitations — spacecraft payloads
[TR-5.336] N87-14418
RANDOM NOISE
Low phase noise oscillator
[NASA-CASE-GSC-13018-1] N87-14596
RANDOM SAMPLING
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
RANDOM VARIABLES
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
RANGEFINDING
Autonomous vehicle navigation
[AD-A170379] N87-14311
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
RATS
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832
RAYLEIGH SCATTERING
Models of polarized infrared emission from bipolar nebulae N87-15050
RAYLEIGH WAVES
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794
RC CIRCUITS
Improved signal delay bounds for RC tree networks
[AD-A169625] N87-14874
REACTION KINETICS
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
Calculation and analysis of chemically reacting supersonic flows N87-14343
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
A precision laser spectrometer system
[AD-A170226] N87-14692
Do large rate coefficients for ion-polar neutral reactions have a serious effect on chemical models of dense clouds? N87-15118
REACTION WHEELS
Solar maximum mission post flight performance analyses of standard reaction wheels S/N's 102, 103, 104 and 105 N87-14381
Emitted vibration measurement device and method
[NASA-CASE-MFS-25981-1] N87-14670
REACTOR CORES
Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452
REACTOR MATERIALS
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652
REAL GASES
Laboratory simulation of the real gas effects of reentry N87-14396
REAL TIME OPERATION
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
Real-time garbage collection for list processing
[NASA-CASE-MSC-20964-1] N87-14863
RECOGNITION
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
RECOMBINATION REACTIONS
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
Methods of plasma excitation
[AD-A170347] N87-15002
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013
RECOVERABILITY
Winged space transporters: The problem of the number of stages — reusable launch vehicles
[ETN-87-98863] N87-14367
RECTANGULAR WAVEGUIDES
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Investigations on a broadband 180 deg hybrid — waveguide
[DFVLR-FB-86-22] N87-14616
RECURSIVE FUNCTIONS
Program synthesis = proof method + knowledge. Example of recursion function synthesis
[RR-605-IMAG-48-LIFIA-I] N87-14903
RED GIANT STARS
Molecular catastrophes and the formation of circumstellar dust N87-15116
REDUCED GRAVITY
Surface tension minimum and Marangoni convection — reduced gravity experiments N87-14409
REDUNDANCY ENCODING
Adaptive transmission rate and variable redundancy systems as a fade countermeasure — satellite communication N87-14562
REENTRY SHIELDING
Ceramic-ceramic shell tile thermal protection system and method thereof
[NASA-CASE-ARC-11641-1] N87-14442
REENTRY VEHICLES
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Prediction methods for the calculation of flow fields around reentry vehicles N87-14395
Laboratory simulation of the real gas effects of reentry N87-14396
REFLECTANCE
Renormalization of an inverse scattering theory for Gaussian dielectric profiles
[AD-A169328] N87-14571
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985
Setup for determining the reflectivity of interference coatings — laser mirrors
[ESA-TT-997] N87-14993
REFLECTION NEBULAE
Summer School on Interstellar Processes: Abstracts of contributed papers
[NASA-TM-88342] N87-15043
Spectroscopy and CCD-photography of extended red emission in reflection nebulae N87-15102
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108
REFLECTORS
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985
REFRACTIVITY
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
REGENERATION (ENGINEERING)
Stationary Markov sets
[AD-A170109] N87-14938
REGENERATION (PHYSIOLOGY)
Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data
[INPE-4035-RPE/522] N87-14764
REGRESSION ANALYSIS
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14933
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936
On the relation between several statistics for testing for exponentiality and uniformity
[AD-A170259] N87-14945
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-608-IMAG-M] N87-14949
REGRESSION COEFFICIENTS
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936

REGULATORS
Preliminary consideration on robustness of nonlinear discrete-time regulators
[INPE-4015-RPE/520] N87-14917
REJECTION
Pulse amplifier with high common-mode rejection
[DIGEL-70] N87-14615
RELATIVISTIC ELECTRON BEAMS
Soviet development of gyrotrons
[AD-A169680] N87-14690
Two-stage FEL (Free Electron Laser) research at KMS Fusion, Inc.
[AD-A170828] N87-14696
RELIABILITY ANALYSIS
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948
RELIABILITY ENGINEERING
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-98586] N87-14871
REMOTE CONTROL
Remote operation and maintenance demonstration facility at the Oak Ridge National Laboratory
[DE86-012621] N87-14706
REMOTE SENSING
A computer interface for digital control of a dc power source, appendix E N87-14626
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806
Methods of remote evaluation of chlorophyll concentration in the sea
[DRIC-T-7652] N87-14824
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set — X-band SLAR
[CNES-85/187T/CT/DRT/TIT/RL] N87-14826
RENDEZVOUS TRAJECTORIES
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
REPLACING
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973
RESEARCH
Compendium of research
[AD-A170356] N87-15024
RESEARCH MANAGEMENT
German-Austrian stellar triangulation project using balloon sondes. Development and purpose of the project N87-14759
Composition of the WMO
[WMO/OMM-5] N87-14820
Compendium of research
[AD-A170356] N87-15024
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
RESIDUAL STRESS
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733
RESISTOJET ENGINES
Electric propulsion options for the SP-100 reference mission
[NASA-TM-88918] N87-14422
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14426
RESONANCE FLUORESCENCE
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
RESOURCES
Updated wind energy resource assessment of the US
[DE86-015788] N87-14773
RESPIRATORY DISEASES
Some evidence on non-transmissibility of acute upper respiratory disease and related matters
[PREPRINT-115] N87-14842
RETURN TO EARTH SPACE FLIGHT
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860
REUSABLE LAUNCH VEHICLES
Winged space transporters: The problem of the number of stages — reusable launch vehicles
[ETN-87-98863] N87-14367
REYNOLDS NUMBER
Effect of Reynolds number on turbomachines N87-14345
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
RHOMBIC ANTENNAS
A practical guide to the design of rhombic aerials
[RAE-TM-RAD-NAV-266] N87-14566
RIGID STRUCTURES
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370
RIVETED JOINTS
Fault detection sensitivity in thick light alloy specimens, test report
[REPT-47-084/F] N87-14721
ROADS
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
ROBOTICS
Passively activated prehensile digit for a robotic end effector
[NASA-CASE-NPO-16766-1-CU] N87-14705
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854
ROBOTS
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
ROBUSTNESS (MATHEMATICS)
Robust stability under additive perturbations: An implicit assumption — control stability
[OUEL-1622/86] N87-14912
Preliminary consideration on robustness of nonlinear discrete-time regulators
[INPE-4015-RPE/520] N87-14917
ROCKET ENGINES
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Aerodynamic design and test of a supersonic turbine for a rocket engine — Ariane 5 N87-14400
Low loss injector for liquid propellant rocket engines
[NASA-CASE-MFS-25989-1] N87-14420
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers
[NASA-TM-88805] N87-14426
ROCKET EXHAUST
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249
Rocket exhaust plume flow into space N87-14403
Dynamic aspects of rocket plume impingement N87-14404
Rocket plume contamination and surface interaction effects — spacecraft structures N87-14405
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
ROCKET THRUST
Base pressure control for aerospace vehicles N87-14412
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14426
ROCKET VEHICLES
Base pressure control for aerospace vehicles N87-14412
ROCKS
Nonlinear wave propagation study
[AD-A170201] N87-14572
RODS
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325
ROOTS OF EQUATIONS
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
ROTARY WING AIRCRAFT
High lift, low pitching moment airfoils
[NASA-CASE-LAR-13215-1] N87-14282
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-526] N87-14304
ROTARY WINGS
A method for the manufacture of model helicopter rotor blades from glass fiber reinforced plastic
[RAE-TR-85040] N87-14316
ROTATING BODIES
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients
[NASA-TM-88490] N87-14281
ROTATING CYLINDERS
The deduction of bearing forces in rotating machinery — ship machinery
[BR99658] N87-14372
ROTATING DISKS
Magnetic braking in weakly ionized circumstellar disks N87-15129
ROTATING PLASMAS
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688
ROTATION
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
ROTOR AERODYNAMICS
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910
ROTOR BLADES (TURBOMACHINERY)
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341
RUBBER
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
RUNGE-KUTTA METHOD
An easily vectorizable numerical solution of the Euler equations N87-14258
Phase lag analysis of implicit Runge-Kutta methods
[CWI-NM-R8612] N87-14928
Stabilization of the Lax-Wendroff methods and a generalized one-step Runge-Kutta method for hyperbolic initial-value problems
[CWI-NM-R8613] N87-14929
RUNWAY CONDITIONS
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982
[NASA-TM-88007] N87-14305
RUNWAYS
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792

S

S WAVES
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
Experimental evidence of MHD surface wave
[ISSN-0469-4732] N87-14997
SAAB AIRCRAFT
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
SAFETY DEVICES
Two-phase flow through safety devices and valves N87-14552
SAFETY FACTORS
Space shuttle accident
[S-HRG-99-967] N87-14369
SAGNAC EFFECT
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974
SAMPLING
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944

SAND CASTING
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
SANDWICH STRUCTURES
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414
SATELLITE ATTITUDE CONTROL
Forced motion on spinning test for slosh-moment investigations — spacecraft stability N87-14406
SATELLITE DESIGN
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770
SATELLITE IMAGERY
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170899] N87-14768
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140
SATELLITE INTERCEPTORS
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415
SATELLITE NETWORKS
Development of the design concept for a variable rate system for the 30/20 GHz Olympus trial N87-14565
Development of transmission facilities for electronic media in the Netherlands
[EUT-86-E-158] N87-14585
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589
SATELLITE ORBITS
Stationkeeping of libration point orbits, executive summary
[ESA-CR(P)-2272] N87-14363
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
SATELLITE ORIENTATION
Alternative mathematical programming formulations for FSS synthesis
[NASA-CR-180030] N87-14872
SATELLITE PERTURBATION
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
SATELLITE TRANSMISSION
Fade countermeasures for satellite communications
[ESA-STM-235] N87-14560
Alleviation of fading effects in radiopaths by fade-spreading N87-14561
Adaptive transmission rate and variable redundancy systems as a fade countermeasure — satellite communication N87-14562
Adaptive TDMA as a means of trading power against bandwidth — satellite transmission N87-14563
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589
SATELLITE-BORNE PHOTOGRAPHY
Automatic picture transmission receivers for weather satellite images. A brief introduction and survey of some commercially-available equipment
[AD-A170359] N87-14574
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
SCALE EFFECT
Scaled centrifugal compressor program
[NASA-CR-174912] N87-14349
SCALING LAWS
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794
SCATTERING
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
SCATTERING COEFFICIENTS
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978
SCATTERING CROSS SECTIONS
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne
[MPIS-2/1986] N87-14475
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
SCATTEROMETERS
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
SCENE ANALYSIS
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033
SCHEDULING
Post-Challenger assessment of space shuttle flight rates and utilization
[NASA-CR-180105] N87-14368
SCREWS
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445
SCRUBBERS
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708
SEA ICE
The ice conditions in the Greenland waters, 1979
[ISBN-87-7478-261-4] N87-14827
SEAT BELTS
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1
[DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual
[DOT/FAA/CT-86/25-2] N87-14307
SECURITY
Strategic defense initiative and the prospects for international cooperation in space
[DE86-016153] N87-15029
SEISMIC WAVES
Redetermination of earthquake body-wave magnitudes (m sub b) using ISC bulletin data — International Seismological Center (ISC)
[AWRE-O-21/85] N87-14790
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879
SEISMOLOGY
Redetermination of earthquake body-wave magnitudes (m sub b) using ISC bulletin data — International Seismological Center (ISC)
[AWRE-O-21/85] N87-14790
SELECTIVE FADING
Alleviation of fading effects in radiopaths by fade-spreading N87-14561
SELF ADAPTIVE CONTROL SYSTEMS
Reduced complexity set-point following in self-tuning control
[OUEL-1626/86] N87-14913
SELF ERECTING DEVICES
Foldable self-erecting joint
[NASA-CASE-MSC-20635-1] N87-14373
SEMANTICS
Algebraic specifications of computable and semicomputable data types — software engineering
[CWI-CS-R8619] N87-14895
SEMICONDUCTOR DEVICES
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584
Survey of materials and device technologies for high-temperature (T300C) power semiconductor electronics
[DE86-015822] N87-15017
SEMICONDUCTOR DIODES
Quantum well electron barrier diode
[AD-D012432] N87-14600
SEMICONDUCTOR LASERS
Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy
[INPE-3992-PRE/992] N87-15005
SEMICONDUCTORS (MATERIALS)
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
Liquid encapsulated float zone process and apparatus
[NASA-CASE-MFS-28144-1] N87-15004
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013
Survey of materials and device technologies for high-temperature (T300C) power semiconductor electronics
[DE86-015822] N87-15017
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
SEPARATED FLOW
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
Study of phenomena of unsteady boundary-layer separation
[AD-A170426] N87-14649
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
Criteria for separation in two-dimensional steady and unsteady compressible flow
[ESA-TT-985] N87-14668
SERIES (MATHEMATICS)
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943
SERIES EXPANSION
Model for describing probability distributions in chains of events
[FOA-C-20619-2.6(2.7)] N87-14947
SERVICE LIFE
Easily stated but hard statistical problems
[AD-A170057] N87-14935
SET THEORY
Stationary Markov sets
[AD-A170109] N87-14938
SEYFERT GALAXIES
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
SHAKERS
The deduction of bearing forces in rotating machinery — ship machinery
[BR99658] N87-14372
SHAPES
Developments in blade shape design for a Darrieus vertical axis wind turbine
[DE86-016056] N87-14774
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
SHARP LEADING EDGES
Modeling three dimensional vortex flow in aerodynamics N87-14636
SHEAR FLOW
Stability of a shear model in which perturbations move with the mean local flow
[PB86-232469] N87-14805
SHEAR PROPERTIES
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects
[AD-A170644] N87-14736
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738
SHEAR STRESS
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
SHIELDING
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
SHIPS
The deduction of bearing forces in rotating machinery — ship machinery
[BR99658] N87-14372
International list of selected, supplementary and auxiliary ships — Global Observing System
[WMO/OMM-47-ED-86] N87-14819
SHOCK TUBES
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975
SHOCK WAVE INTERACTION
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14665

SHOCK WAVE LUMINESCENCE
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
SHOCK WAVE PROPAGATION
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879
Observational discrimination between modes of shock propagation in interstellar clouds: Predictions of CH+ and SH+ column densities in diffuse clouds N87-15081
SHOCK WAVES
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Shock oscillations in transonic nozzle flows
[MPIS-7/1986] N87-14294
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms
[NASA-TM-89415] N87-14916
SHORT CIRCUITS
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
SHORT CRACKS
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
Ultrasonic fatigue studies of short and long surface cracks
[FFA-TN-1986-44] N87-14746
SHROUDS
Radiation from an element in an array to its surroundings, appendix C N87-14624
SHUTTLE PALLET SATELLITES
Heat pipe experiment on SPAS 01 N87-14411
Investigation of the influence of the impact friction coefficient on pneumatic conveying (Friction Pressure Loss (FPL) 304)
[BMFT-FB-W-86-009] N87-14711
SIDE-LOOKING RADAR
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set — X-band SLAR
[CNES-85/187T/CT/DRT/TIT/RL] N87-14828
SIDESLIP
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
SIGNAL ANALYSIS
Acoustic emission frequency discrimination
[NASA-CASE-MSC-20467-1] N87-14676
Large signal modeling and analysis of the GaAs MESFET
[AD-A170304] N87-15011
Delay estimation in digital correlation interferometers with special consideration of the MK 2 system of the Max-Planck Institute of Radio Astronomy
[REPT-68] N87-15038
SIGNAL DETECTION
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720
SIGNAL DISTORTION
Reduced tolerance imaging I
[AD-A170932] N87-14882
SIGNAL ENCODING
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584
SIGNAL FADING
Fade countermeasures for satellite communications
[ESA-STM-235] N87-14560
Adaptive transmission rate and variable redundancy systems as a fade countermeasure — satellite communication N87-14562
Adaptive TDMA as a means of trading power against bandwidth — satellite transmission N87-14563
Uplink power control of satellite Earth stations as a fade-countermeasure of 20/30 GHz communication systems N87-14564
SIGNAL PROCESSING
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170655] N87-14601
A computer interface for digital control of a dc power source, appendix E N87-14626
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720
SIGNAL TO NOISE RATIOS
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170829] N87-14577
A noise reduction system for video signals with a low signal to noise ratio
[ETN-86-98720] N87-14614
SIGNAL TRANSMISSION
Development of transmission facilities for electronic media in the Netherlands
[EUT-86-E-158] N87-14585
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654
SILANES
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016
SILICATES
The shapes of the circumstellar silicate features N87-15111
SILICON
A survey of algorithms for integrating wafer-scale systolic arrays
[AD-A171623] N87-14602
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983
SILICON CARBIDES
Production of aluminum-silicon carbide composites
[ETN-86-98696] N87-14446
Fiber reinforced ceramic material
[NASA-CASE-LEW-14392-1] N87-14517
High-temperature effect of hydrogen on sintered alpha-silicon carbide
[NASA-TM-88819] N87-14518
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
SILICON DIOXIDE
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
SILICON NITRIDES
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
SILICON OXIDES
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
SILICON RADIATION DETECTORS
New detector concepts — silicon radiation detectors
[MPE-PAE/EXP-E1-164] N87-14683
SILOXANES
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N87-14516
SIMILITUDE LAW
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14665
SIMULATION
Renormalization of an inverse scattering theory for Gaussian dielectric profiles
[AD-A169328] N87-14571
Detection and representation of planar surfaces in three dimensional range images
[FOA-C-30427-E1] N87-14588
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753
A simulation feasibility study
[AD-A169651] N87-14793
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941
SINGLE CRYSTALS
The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525
High temperature properties and processes in ceramics: Thermomigration
[DE86-015035] N87-14531
Growth of a silicon single crystal by the floating-zone technique under micro-g conditions during Spacelab 1
[BMFT-FB-W-86-004] N87-14542
Preparation of a solvent zone crystallization experiment of cadmium telluride during the First SpaceLab Project (FSLP) Spacelab mission
[BMFT-FB-W-86-005] N87-14543
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008
SINGLE SIDEBAND TRANSMISSION
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720
SINGULARITY (MATHEMATICS)
Nonsingular parametric expressions for orbit propagation by theoretical estimation of parameters
[INPE-4024-TDL/241] N87-14360
SINKHOLES
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792
SINTERING
Development of a suitable powder metal on iron base for general use in highly loaded slide bearings
[BMFT-FB-T-86-056] N87-14507
High-temperature effect of hydrogen on sintered alpha-silicon carbide
[NASA-TM-88819] N87-14518
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521
SITE SELECTION
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829
SIZE (DIMENSIONS)
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857
Size-density relations in dark clouds: Non-LTE effects N87-15068
SIZE DISTRIBUTION
Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109
SKY
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808
SLAGS
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457
SLEEP DEPRIVATION
Noise disturbance at night near Heathrow and Gatwick airports: 1984 check study — London airports
[DR-8513] N87-14781
SLENDER BODIES
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients
[NASA-TM-88490] N87-14281
SLIPSTREAMS
Aerodynamic characteristics of general aviation at high angle of attack with the propeller slipstream
[NASA-TM-88503] N87-14260
SMOKE
Cables and fire hazards
[NASA-TM-88493] N87-14553
SNOW
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812
SODIUM SULFUR BATTERIES
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
SOFTWARE ENGINEERING
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878
Module algebra — software engineering
[CWI-CS-R8617] N87-14894
Algebraic specifications of computable and semicomputable data types — software engineering
[CWI-CS-R8619] N87-14895

Evaluation of methods for coordination of software technological tasks using examples of the Spacelab program and air surveillance program. Part 3: Experience report for a software project for air surveillance
[BMFT-FB-DV-86-005] N87-14896
Program synthesis = proof method + knowledge. Example of recursion function synthesis
[RR-605-IMAG-48-LIFIA-I] N87-14903

SOFTWARE TOOLS
Module algebra — software engineering
[CWI-CS-R8617] N87-14894

SOIL MECHANICS
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/18,4] N87-14554
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879

SOIL SCIENCE
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879

SOLAR ACTIVITY
Solar-geophysical data number 502, June 1986. Part 1: (Prompt reports). Data for May 1986, April 1986 and late data
[PB86-224011] N87-14803
Solar-geophysical data number 502, June 1986. Part 2: (Comprehensive reports). Data for December 1985 and miscellanea
[PB86-224029] N87-14804
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042

SOLAR ATMOSPHERE
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153

SOLAR CELLS
Design, analysis and test verification of advanced encapsulated systems
[NASA-CR-177076] N87-14619
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
Investigation of the optical properties of solar cells
[BMFT-FB-T-86-008] N87-14989

SOLAR CORONA
An atlas of photospheric magnetic field observations and computed coronal magnetic fields: 1976 - 1985
[NASA-CR-180019] N87-15151

SOLAR DYNAMIC POWER SYSTEMS
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771
Advanced Stirling conversion systems for terrestrial applications
[NASA-TM-88897] N87-15031

SOLAR ENERGY
Applied system analysis no. 45: SOLARYS, an interactive model for the simulation of solar systems, parts 1 and 2 — solar energy
[JUEL-SPEZ-346-PT-1-PT-2] N87-14775

SOLAR ENERGY CONVERSION
German-Korean cooperation for erection and test of industrialized solar technologies
[BMFT-FB-T-86-006] N87-14777
Brayton cycle solarized advanced gas turbine
[NASA-CR-179559] N87-15030
Advanced Stirling conversion systems for terrestrial applications
[NASA-TM-88897] N87-15031

SOLAR FLARES
A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite
[AD-A170139] N87-15152

SOLAR FLUX
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361

SOLAR FLUX DENSITY
On 10-60 GHz G/T measurements using the Sun as a source: A preliminary study
[PB86-230034] N87-14595
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042

SOLAR GENERATORS
German-Korean cooperation for erection and test of industrialized solar technologies
[BMFT-FB-T-86-006] N87-14777

SOLAR MAGNETIC FIELD
An atlas of photospheric magnetic field observations and computed coronal magnetic fields: 1976 - 1985
[NASA-CR-180019] N87-15151

SOLAR MAXIMUM MISSION
Proceedings of the SMRM Degradation Study Workshop
[NASA-TM-88274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
The Main Electronics Box (MEB) of the HAO coronagraph/polarimeter N87-14376
Radiation effects on selected electronics parts from the solar max satellite N87-14377
Failure analysis and performance evaluation of NASA inertial reference unit (DRIRU 2) after 50 months of orbital operation N87-14378
Analysis of DRIRU bearings and lubricant from solar max repair mission N87-14379
Postflight evaluation of the solar maximum spacecraft magnetometers N87-14380
Solar maximum mission post flight performance analyses of standard reaction wheels S/N's 102, 103, 104 and 105 N87-14381
Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382
Results of examination of materials from the solar maximum recovery mission N87-14383

SOLAR NEUTRINOS
The X-ray and gamma-ray astronomy (including non-photon astronomy)
[MPE-PREPRINT-58] N87-15039

SOLAR PHYSICS
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite
[AD-A170139] N87-15152

SOLAR PROMINENCES
Solar-geophysical data number 502, June 1986. Part 2: (Comprehensive reports). Data for December 1985 and miscellanea
[PB86-224029] N87-14804

SOLAR RADIATION
Analysis of normal and transparent silver Teflon N87-14391
Solar maximum thermal surface assessment N87-14393
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808

SOLAR REFLECTORS
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423

SOLAR SYSTEM
The planets of the Solar System
[NASA-TM-88015] N87-15148

SOLAR TERRESTRIAL INTERACTIONS
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14996
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

SOLAR THERMAL ELECTRIC POWER PLANTS
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772

SOLAR WIND
Evolution and interaction of large interplanetary streams
[NASA-TM-86192] N87-15131
Space research in Belgium
[ISSN-0772-9604] N87-15159

SOLAR X-RAYS
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study
[NASA-CR-177900] N87-15150

SOLID PROPELLANT COMBUSTION
Microwave measurement of the combustion velocity of solid propellants (4)
[ONERA-RTS-11/3173-EY] N87-14476

SOLID STATE DEVICES
Further developments of the Solid State Automated Microscope (SSAM)
[ETN-87-98693] N87-14991

SOLID-SOLID INTERFACES
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

SOLIDIFICATION
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714

SONDES
German-Austrian stellar triangulation project using balloon sondes
[SER-B-278] N87-14758
German-Austrian stellar triangulation project using balloon sondes. Development and purpose of the project N87-14759
German-Austrian stellar triangulation project using balloon sondes. Engineering and observations N87-14760
German-Austrian stellar triangulation project using balloon sondes. Evaluation of observations and analysis of the results N87-14761

SOUND TRANSMISSION
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655

SOUND WAVES
Propagation of sound waves in tubes of noncircular cross section
[NASA-TP-2601] N87-14284
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794

SOUNDING ROCKETS
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791

SPACE BASES
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230620] N87-15023

SPACE COLONIES
Report of the National Commission on Space
[S-HRG-99-954] N87-15028

SPACE COMMERCIALIZATION
Report of the National Commission on Space
[S-HRG-99-954] N87-15028

SPACE DEBRIS
Analysis of micrometeorite material captured by the solar max satellite N87-14385
Examination of returned solar-max surfaces for impacting orbital debris and meteoroids N87-14386

SPACE ERECTABLE STRUCTURES
Foldable self-erecting joint
[NASA-CASE-MSC-20635-1] N87-14373

SPACE EXPLORATION
Extraterrestrial research in the Federal Republic of Germany
[NASA-TM-88010] N87-14358
Report of the National Commission on Space
[S-HRG-99-954] N87-15028
Planetary exploration through year 2000, a core program: Mission operations
[NASA-TM-89275] N87-15138
Phobos and Deimos: Satellites of Mars
[NASA-TM-88016] N87-15142

SPACE FLIGHT
Radiation effects in space
[DE86-013257] N87-14841

SPACE MANUFACTURING
Space technology in Berlin. Volume 1: Ideas for the establishment of an institute for space processing technology
[NASA-TM-87994] N87-14541

SPACE OBSERVATIONS (FROM EARTH)
High resolution observations of the L1551 bipolar outflow N87-15046

Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Pervasive small-scale structure in molecular clouds N87-15055
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060

SPACE PLATFORMS
The Geoscience Laser Altimetry/Ranging System (GLARS)
[NASA-TM-87803] N87-14687

SPACE PROCESSING
Space technology in Berlin. Volume 1: Ideas for the establishment of an institute for space processing technology
[NASA-TM-87994] N87-14541

SPACE PROGRAMS
Extraterrestrial research in the Federal Republic of Germany
[NASA-TM-88010] N87-14358
Space shuttle accident
[S-HRC-99-967] N87-14369

SPACE RENDEZVOUS
Analysis of rendezvous and docking in geostationary Earth orbit. Rider to comparison of future communications space segment concepts
[DM51-C/PL/FL/0099.82] N87-14364

SPACE SHUTTLE ORBITERS
Archive data base and handling system for the Orbiter flying qualities experiment program
[NASA-CR-166622] N87-14351

SPACE SHUTTLES
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449

SPACE STATIONS
High- and low-thrust propulsion systems for the space station
[NASA-TM-88677] N87-14427
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

SPACE SURVEILLANCE (SPACEBORNE)
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230620] N87-15023

SPACE TRANSPORTATION
Space technology in Berlin. Volume 1: Ideas for the establishment of an institute for space processing technology
[NASA-TM-87994] N87-14541

SPACE TRANSPORTATION SYSTEM
Winged space transporters: The problem of the number of stages — reusable launch vehicles
[ETN-87-98863] N87-14367
Post-Challenger assessment of space shuttle flight rates and utilization
[NASA-CR-180105] N87-14368
Preliminary results from the EMTE fuel slosh flight experiment — STS-16 N87-14410
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

SPACEBORNE EXPERIMENTS
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Observations on behavior of liquid in weightlessness N87-14408
Preliminary results from the EMTE fuel slosh flight experiment — STS-16 N87-14410
Heat pipe experiment on SPAS 01 N87-14411
Investigation of the influence of the impact friction coefficient on pneumatic conveying (Friction Pressure Loss (FPL) 304)
[BMFT-FB-W-86-009] N87-14711
Research and technology, fiscal year 1986, Marshall Space Flight Center
[NASA-TM-86567] N87-15034

SPACEBORNE TELESCOPES
Evaluation of low density mirror blanks for space observatories
[SIRA-A/7123/00] N87-14987

SPACECRAFT COMMUNICATION
Packet telemetry — Spacecraft data
[MATRA-RF/176/0898-ISSUE-1-REV.] N87-14371
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584

SPACECRAFT COMPONENTS
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414

SPACECRAFT CONSTRUCTION MATERIALS
First International Conference Materials in Aerospace
[BAE-S85/AMR/0080] N87-14243
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170218] N87-14493

SPACECRAFT CONTAMINATION
Dynamic aspects of rocket plume impingement N87-14404
Rocket plume contamination and surface interaction effects — spacecraft structures N87-14405

SPACECRAFT CONTROL
Archive data base and handling system for the Orbiter flying qualities experiment program
[NASA-CR-166622] N87-14351
Fluid dynamic problems in space systems N87-14402

SPACECRAFT DESIGN
An overview of the British Aerospace HOTOL transatmospheric vehicle
[NASA-TM-88008] N87-14317
Vehicle geometry effects on hypersonic stability and control N87-14397
Fluid dynamic problems in space systems N87-14402
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407
Magnitude equivalence of random loads and superposition with transient excitations — spacecraft payloads
[TR-5.338] N87-14418
Evaluation of functions and interfaces for computer aided engineering in support of space systems design, management study
[ESA-CR(P)-2222] N87-14901

SPACECRAFT DOCKING
Rendezvous and docking (RVD) guidance simulation program, rider 2
[MATRA-EPT/DT/VT068/012] N87-14359
Analysis of rendezvous and docking in geostationary Earth orbit. Rider to comparison of future communications space segment concepts
[DM51-C/PL/FL/0099.82] N87-14364

SPACECRAFT GUIDANCE
Rendezvous and docking (RVD) guidance simulation program, rider 2
[MATRA-EPT/DT/VT068/012] N87-14359

SPACECRAFT MANEUVERS
A method for governing spacecraft evasive manauvering
[AD-A170696] N87-14415

SPACECRAFT MODELS
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430

SPACECRAFT POWER SUPPLIES
Dynamic Current Detector (DCD) — spacecraft power supplies
[SD/REPO/0001] N87-14610
Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170638] N87-14651
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860
Inertial fusion power for space applications
[DE86-011879] N87-14969
Advanced Stirling conversion systems for terrestrial applications
[NASA-TM-88697] N87-15031

SPACECRAFT PROPULSION
Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives
[ETN-87-98751] N87-14331
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
Combined propulsion systems, aerothermodynamic processes and an evaluation study of propulsion components and systems N87-14345
Dual-thrust thruster thermal model
[NASA-CR-178975] N87-14424
High- and low-thrust propulsion systems for the space station
[NASA-TM-88677] N87-14427
Combined spacecraft propulsion systems
[ETN-87-98864] N87-14431

SPACECRAFT RADIATORS
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407

SPACECRAFT REENTRY
Ceramic-ceramic shell tile thermal protection system and method thereof
[NASA-CASE-ARC-11641-1] N87-14442

SPACECRAFT STRUCTURES
Dynamic aspects of rocket plume impingement N87-14404
Rocket plume contamination and surface interaction effects — spacecraft structures N87-14405

SPACELAB PAYLOADS
Growth of a silicon single crystal by the floating-zone technique under micro-g conditions during Spacelab 1
[BMFT-FB-W-86-004] N87-14542
Preparation of a solvent zone crystallization experiment of cadmium telluride during the First SpaceLab Project (FSLP) Spacelab mission
[BMFT-FB-W-86-005] N87-14543
Spacelab Lyman Alpha-White Light Coronagraph Program
[NASA-CR-177902] N87-14674
Space research in Belgium
[ISSN-0772-9804] N87-15159

SPATIAL DISTRIBUTION
Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet
[NASA-TM-88922] N87-14283
The molecular content of the nearby galaxy from IRAS and HI observations N87-15087

SPATIAL FILTERING
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170829] N87-14577
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048

SPATIAL RESOLUTION
High spatial resolution passive microwave sounding systems
[NASA-CR-180025] N87-14568
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048

SPECIFIC HEAT
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

SPECIFICATIONS
Algebraic specifications of computable and semicomputable data types — software engineering
[CWI-CS-R8619] N87-14895
Unique coupler evaluation techniques and results
[DE86-012101] N87-14982

SPECIMEN GEOMETRY
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444

SPECTRA
Field study of wind through and over a forest edge
[AD-A169491] N87-14809

SPECTRAL EMISSION
Models of polarized infrared emission from bipolar nebulae N87-15050
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Pervasive small-scale structure in molecular clouds N87-15055
HC3N maps of OMC1 N87-15056
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
Near-infrared observations of IRAS sources in and near dense cores N87-15061
Spectral evolution of young stellar objects N87-15066
Near-infrared spectroscopy of planetary nebulae: How strong is the H2 emission? N87-15074
A CC J = 2 1 survey of the galactic center region N87-15082

SPECTRAL ENERGY DISTRIBUTION
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961

SPECTRAL LINE WIDTH
Pervasive small-scale structure in molecular clouds N87-15055

Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127

SPECTRAL RESOLUTION

Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106

SPECTROGRAPHS

Optimization of spectrographic trace analysis N87-14455

SPECTROMETERS

Method of fabricating an imaging X-ray spectrometer [NASA-CASE-GSC-12956-1] N87-14671

Calibration of the fast 12-channel Electron Cyclotron Emission (ECE) spectrometer at Joint European Torus (JET) [REPT-86-168] N87-14970

FUSE/Lyman grant [NASA-CR-180024] N87-14972

SPECTROSCOPIC ANALYSIS

Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods [JUEL-CONF-55] N87-14450

Analysis of ferrous materials — mass spectrometry N87-14451

Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452

Potential of high temperature mass spectrometry for the analysis of materials N87-14453

Optimization of spectrographic trace analysis N87-14455

Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456

Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457

A stabilized dc plasma and an advanced spectrochemical analysis system N87-14458

A comparison of trace element analysis of whole coal by INAA and XRFS — instrument neutron activation analysis (INAA); X-ray fluorescence spectroscopy (XRFS) N87-14460

Structural features of corundum color varieties by spectroscopic methods N87-14461

SPECTROSCOPY

Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems [AD-A170148] N87-14471

Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers [AD-A170126] N87-14691

Activities of the 1st International Laser Science Conference [AD-A173080] N87-14699

Coherent phonon generation and high frequency phonon spectroscopy [AD-A169031] N87-14961

SPECTRUM ANALYSIS

The application of ultrasonic attenuation spectral analysis to materials characterisation [AERE-R-11885] N87-14755

Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106

Comet P/Halley 1910, 1986: An objective-prism study N87-15130

SPIN DYNAMICS

Turbulence modeling for steady three-dimensional supersonic flows [AD-A170042] N87-14285

PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles [AD-A169531] N87-14647

Coherent phonon generation and high frequency phonon spectroscopy [AD-A169031] N87-14961

SPIN STABILIZATION

Forced motion on spinning test for slosh-moment investigations — spacecraft stability N87-14406

PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles [AD-A169531] N87-14647

SPINEL

High specific heat dielectrics and Kapitza resistance at dielectric boundaries [AD-A169954] N87-15007

SPIRAL GALAXIES

Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090

Local interstellar gasdynamical stability in spiral arm flow N87-15092

Chemical evolution in spiral and irregular galaxies N87-15097

SPREAD SPECTRUM TRANSMISSION

Alleviation of fading effects in radiopaths by fade-spreading N87-14561

SPUTTERING

Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions [DE86-014345] N87-15003

STABILITY

Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet [NASA-TM-88922] N87-14283

Preliminary consideration on robustness of nonlinear discrete-time regulators [INPE-4015-RPE/520] N87-14917

STAGNATION FLOW

Field study of wind through and over a forest edge [AD-A169491] N87-14809

STAINLESS STEELS

Testing of high alloy steels for new hydrometallurgical processes and chemical plants [BMFT-FB-T-86-055] N87-14506

FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel [AERE-R-11937] N87-14511

Development of a copy-peeling machine for machining the surface of hot rolled square billets [BMFT-FB-HA-86-004] N87-14555

STANDARDS

Packet telemetry — Spacecraft data [MATRA-RF/176/0696-ISSUE-1-REV.] N87-14371

Analyses of the phosphate standard of the Egyptian Nuclear Materials Corporation (phosphate 1) N87-14459

Noise certification and noise sensitivity studies on the BO-105 helicopter [DFVLR-MITT-86-13] N87-14958

STAR CLUSTERS

CO near the Pleiades: Encounter of a star cluster with a small molecular cloud N87-15071

Optical observations of very low ionization HII regions in the large Magellanic cloud N87-15072

STAR FORMATION

Far-infrared investigation of the Taurus star-forming region using the IRAS database N87-15044

MM and subMM molecular line observations of the southwest lobe of L1551: Evidence of a shell structure N87-15045

High resolution observations of the L1551 bipolar outflow N87-15046

A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4" resolution N87-15047

Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048

Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051

CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057

Filamentary structure in the Orion molecular cloud N87-15058

H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059

Grain processes in massive star formation N87-15063

Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064

Supershells and propagating star formation N87-15067

Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs [DE86-016168] N87-15135

STAR TRACKERS

Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382

STARK EFFECT

Stark ladder density of states in a finite crystal [DE86-702908] N87-15015

STATIC FIRING

Field emission electric propulsion. Industrial development of emitters modules, phase 1B [TS/SL/194/DV/30.094/82] N87-14429

STATIC LOADS

Mixed mode 1 and 2 fully plastic crack growth [AD-A170645] N87-14737

Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load [DFVLR-FB-86-30] N87-14751

STATIC TESTS

Static and dynamic testing of interceptor substructures [AD-A169732] N87-14731

STATIONKEEPING

Stationkeeping of libration point orbits, executive summary [ESA-CR(P)-2272] N87-14383

STATISTICAL ANALYSIS

Updated wind energy resource assessment of the US [DE86-015788] N87-14773

Easily stated but hard statistical problems [AD-A170057] N87-14935

STATISTICAL DISTRIBUTIONS

A simulation feasibility study [AD-A169651] N87-14793

On the relation between several statistics for testing for exponentiality and uniformity [AD-A170259] N87-14945

Mass return to the interstellar medium from highly-evolved carbon stars N87-15078

STATORS

Instationary flow effects in the rotor of a turbine [ESA-TT-1001] N87-14663

STEADY FLOW

Turbulence modeling for steady three-dimensional supersonic flows [AD-A170042] N87-14285

A numerical study of incompressible juncture flows [NASA-TM-88319] N87-14644

STEAM

Steam explosions and associated hazards N87-14550

STEAM FLOW

Steam explosions and associated hazards N87-14550

STEELS

Hot forming of thick plates [CETIM-13-J-122] N87-14505

The performance of zinc phosphate two-pack epoxy primers [MQAD-TP-917] N87-14514

Tools for high velocity surface milling of steels [CETIM-106030] N87-14710

Load interaction effects on fatigue crack propagation in steels of varying strength [FFA-TN-1986-47] N87-14747

Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique [AERE-R-12071] N87-14754

STELLAR ATMOSPHERES

Heterodyne spectroscopy of planetary and stellar atmospheres at a wavelength of 11 micrometers [MPE-198] N87-15040

STELLAR COMPOSITION

Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069

The shapes of the circumstellar silicate features N87-15111

STELLAR CORONAS

A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite [AD-A170139] N87-15152

STELLAR ENVELOPES

A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4" resolution N87-15047

Models of polarized infrared emission from bipolar nebulae N87-15050

Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051

The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052

Near-infrared observations of IRAS sources in and near dense cores N87-15061

Spectral evolution of young stellar objects N87-15066

Supershells and propagating star formation N87-15067

The clumpy circumstellar medium around young supernova remnants N87-15079

The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112

STELLAR EVOLUTION

Spectral evolution of young stellar objects N87-15066

Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069

Turbulence in HII regions N87-15070

Mass return to the interstellar medium from highly-evolved carbon stars N87-15078

The clumpy circumstellar medium around young supernova remnants N87-15079

The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093

Infrared studies of supernova remnants with the IRAS N87-15104
Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs
[DE86-016168] N87-15135

STELLAR GRAVITATION
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126

STELLAR LUMINOSITY
Near-infrared observations of IRAS sources in and near dense cores N87-15061

STELLAR MAGNETIC FIELDS
Models for application of radiation boundary condition for MHD waves in collapse calculations N87-15128

STELLAR MASS
Grain processes in massive star formation N87-15063
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077
Mass return to the interstellar medium from highly-evolved carbon stars N87-15078

STELLAR MASS ACCRETION
Grain processes in massive star formation N87-15063
Magnetic braking in weakly ionized circumstellar disks N87-15129

STELLAR MASS EJECTION
A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite
[AD-A170139] N87-15152

STELLAR MODELS
Grain processes in massive star formation N87-15063
Models for application of radiation boundary condition for MHD waves in collapse calculations N87-15128
The 35 day cycle of Her X-1: Quality of the clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 — X-ray burster
[MPE-PREPRINT-57] N87-15156

STELLAR MOTIONS
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041

STELLAR RADIATION
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Near-infrared observations of IRAS sources in and near dense cores N87-15061
The 35 day cycle of Her X-1: Quality of the clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155

STELLAR SPECTRA
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Spectral evolution of young stellar objects N87-15066
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 — X-ray burster
[MPE-PREPRINT-57] N87-15156

STELLAR STRUCTURE
Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069
Turbulence in HII regions N87-15070

STELLAR WINDS
A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4' resolution N87-15047
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Optically thin winds from neutron stars
[MPE-PREPRINT-50] N87-15154

STIFFNESS
Mixed mode 1 and 2 fully plastic crack growth
[AD-A170645] N87-14737

STIRLING ENGINES
Advanced Stirling conversion systems for terrestrial applications
[NASA-TM-88897] N87-15031

STIRRING
The continuous production of stir cast material
[ETN-87-98701] N87-14557

STOCHASTIC PROCESSES
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
Stochastic convexity and its applications
[AD-A170112] N87-14939
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-608-IMAG-M] N87-14949
Binary time series with reward. Application to climatology modeling
[ETN-87-98588] N87-14950

STOICHIOMETRY
The 5-(4-Ethynylphenoxy) isophthalic chloride
[NASA-CASE-LAR-13316-2] N87-14515

STORAGE TANKS
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778

STORMS
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814

STRAIN HARDENING
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738

STRAIN RATE
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate
[NASA-TM-88841] N87-14489
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[ESA-TT-960] N87-14994

STRATUS CLOUDS
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results — stratus clouds
[ESA-TT-970] N87-14325

STREAK CAMERAS
High bandwidth analog applications of photonics: Present capabilities and future possibilities
[DE86-014999] N87-14582
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691

STREAK PHOTOGRAPHY
Calibration of ETS videotapes
[AD-A168688] N87-14677

STRESS (PHYSIOLOGY)
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856

STRESS (PSYCHOLOGY)
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830

STRESS ANALYSIS
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods
[AD-A170327] N87-14319
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146

STRESS CONCENTRATION
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739

STRESS CORROSION CRACKING
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502

STRESS CYCLES
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444

STRESS INTENSITY FACTORS
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods
[AD-A170327] N87-14319
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732

Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate
[NLR-MP-85082-U] N87-14744
Ultrasonic fatigue studies of short and long surface cracks
[FFA-TN-1986-44] N87-14746

STRESS MEASUREMENT
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757

STRESS PROPAGATION
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754

STRESS-STRAIN RELATIONSHIPS
The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
Polymers in mechanochemical systems: Structure-property requirements
[DE86-014308] N87-14530

STRETCHING
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral
[GKSS-86/E/15] N87-14752

STRING THEORY
Cosmic superstrings and related topics
[DE86-702738] N87-15133

STRUCTURAL ANALYSIS
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499
Activities report of the Laboratory of Mechanics and Energy Studies
[ETN-87-98577] N87-14558
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731

STRUCTURAL DESIGN
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485
The modelling of creep for engineering design-1 — metals, ceramics
[NPL-DMA-A115] N87-14727
Inertial fusion power for space applications
[DE86-011879] N87-14969

STRUCTURAL MEMBERS
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413

STRUCTURAL PROPERTIES (GEOLOGY)
Structural ensembles of the north belt of Venus deformations and possible mechanisms of their formation
[NASA-TM-88511] N87-15141
Geological-morphological description of the Ishtar Terra (photomap of the Venusian surface sheet B-5)
[NASA-TM-88497] N87-15143
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146

STRUCTURAL STABILITY
Elucidation of the adhesion mechanisms in structural aluminum bondings
[BMFT-FB-W-86-008] N87-14534
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738

STRUCTURAL VIBRATION
Frequency response functions of a nonlinear system
[DE86-016103] N87-14742
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859

SUBMERGED BODIES
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743

SUBMILLIMETER WAVES
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060

SUBROUTINE LIBRARIES (COMPUTERS)
Coordinate free LAP
[AD-A169982] N87-14877

SUBROUTINES
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915
SUBSONIC FLOW
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Jet mixing low — supersonic air flow N87-14339
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14666
A direct method for evaluating the disturbance fields of moving singularities at subsonic speeds in compressible media
[ESA-TT-977] N87-14667
SUBSONIC SPEED
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
SUBSTRATES
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983
SULFUR
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823
SULFUR ISOTOPES
The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093
SULFUR OXIDES
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
SUN
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042
SUPERCOMPUTERS
Techniques to achieve high-speed computations in supercomputers N87-14250
VP series hardware N87-14251
On a data base system for numerical simulator N87-14252
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
SUPERCONDUCTORS
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520
SUPERCOOLING
A theoretical framework for examining geographical variability in the microphysical mechanisms of precipitation development
[AD-A170317] N87-14812
SUPERCRITICAL FLOW
Supercritical blade cascade design N87-14342
SUPERGIANT STARS
Molecular catastrophes and the formation of circumstellar dust N87-15116
SUPERHIGH FREQUENCIES
Uplink power control of satellite Earth stations as a fade-countermeasure of 20/30 GHz communication systems N87-14564
Development of the design concept for a variable rate system for the 30/20 GHz Olympus trial N87-14565
SUPERLATTICES
Stark ladder density of states in a finite crystal
[DE86-702906] N87-15015
SUPERNOVA REMNANTS
Supershells and propagating star formation N87-15067
The clumpy circumstellar medium around young supernova remnants N87-15079
The molecular gas in the supernova remnant IC443 N87-15080
Infrared studies of supernova remnants with the IRAS N87-15104
Some recent infrared spectroscopy of interstellar processes N87-15107
SUPERNOVAE
The bird: A pressure-confined explosion in the interstellar medium N87-15062
Supershells and propagating star formation N87-15067
Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs
[DE86-016168] N87-15135
SUPERSONIC COMPRESSORS
Transonic and supersonic compressors N87-14344
SUPERSONIC FLOW
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
Investigation of Ferri instability in supersonic inlets
[ESA-TT-978] N87-14289
Interferometry — of spatial flows N87-14332
Mass spectrometric concentration measurements in supersonic flows with chemical reactions N87-14334
Multidimensional supersonic flow with supply of heat — flames N87-14337
Calculation and analysis of chemically reacting supersonic flows N87-14343
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125
SUPERSONIC INLETS
Investigation of Ferri instability in supersonic inlets
[ESA-TT-978] N87-14289
SUPERSONIC SPEED
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
SUPERSYMMETRY
Superunification, phase transitions and cosmology
[DE86-702955] N87-15134
SUPPORTS
Remote pivot decoupler pylon: Wing/store flutter suppressor
[NASA-CASE-LAR-13173-1] N87-14314
Spacecraft subsystem support structure
[AD-D012437] N87-14576
SURFACE ACOUSTIC WAVE DEVICES
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
SURFACE CRACKS
A method and a device to determine the crack depth of surface cracks
[BLL-TRANS-AAEC-798-(1797.43)] N87-14728
Ultrasonic fatigue studies of short and long surface cracks
[FFA-TN-1986-44] N87-14746
SURFACE FINISHING
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14508
Development of a copy-peeling machine for machining the surface of hot rolled square billets
[BMFT-FB-HA-86-004] N87-14555
SURFACE PROPERTIES
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003
Structural ensembles of the north belt of Venus deformations and possible mechanisms of their formation
[NASA-TM-88511] N87-15141
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146
Parquet: Regions of areal plastic dislocations (on Venus)
[NASA-TM-88510] N87-15147
SURFACE REACTIONS
Solar maximum thermal surface assessment N87-14393
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962
SURFACE ROUGHNESS
Experience about the application and valuation of roughness strips for boundary layer transition control in wind tunnel tests in the high-speed range
[DFVLR-MITT-86-12] N87-14291
SURFACE WAVES
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
Experimental evidence of MHD surface wave
[ISSN-0469-4732] N87-14997
SURVIVAL
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact
[NASA-TM-88914] N87-14423
SWEEP FREQUENCY
Swept frequency technique for dispersion measurement of microstrip lines
[NASA-TM-88836] N87-14597
SWELLING
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503
SWITCHING CIRCUITS
Quantum well electron barrier diode
[AD-D012432] N87-14600
SYMMETRY
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
SYNCHRONOUS PLATFORMS
Analysis of rendezvous and docking in geostationary Earth orbit. Rider to comparison of future communications space segment concepts
[DM51-C/PL/FL/0099.82] N87-14364
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
SYNCHRONOUS SATELLITES
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
Alternative mathematical programming formulations for FSS synthesis
[NASA-CR-180090] N87-14872
SYNCHROTRON RADIATION
ONR Far East Scientific Bulletin, volume 11, number 2
[AD-A172479] N87-15032
SYNTHESIS (CHEMISTRY)
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis — synthetic routes to monomers for polyimides
[NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures
[NASA-CASE-LEW-14346-1] N87-14433
Polymer precursors for ceramic matrix composites
[NASA-CR-179562] N87-14434
The 5-(4-Ethynylphenoxy) isophthalic chloride
[NASA-CASE-LAR-13316-2] N87-14515
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof
[NASA-CASE-LAR-13318-1] N87-14516
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016
SYNTHETIC APERTURE RADAR
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591
SYNTHETIC APERTURES
Aperture synthesis observations of the molecular ring in the galactic center N87-15083
SYNTHETIC FUELS
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539
SYSTEM EFFECTIVENESS
Compendium of research
[AD-A170356] N87-15024
SYSTEM FAILURES
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
Queueing analysis of fault-tolerant computer systems
[AD-A170303] N87-14865
SYSTEMS ANALYSIS
On the pilot's behavior of detecting a system parameter change
[NASA-TM-88536] N87-14846
Queueing analysis of fault-tolerant computer systems
[AD-A170303] N87-14865
Optimal allocation of multistate components
[AD-A170081] N87-14937
SYSTEMS ENGINEERING
Design of profiles for cascades N87-14340
Supercritical blade cascade design N87-14342
Fluid dynamic problems in space systems N87-14402
Development of the design concept for a variable rate system for the 30/20 GHz Olympus trial N87-14565
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580
Modeling of telecommunication systems operated with advanced capacity reservation
[ENST-86E006] N87-14586

Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878
Evaluation of functions and interfaces for computer aided engineering in support of space systems design, management study
[ESA-CR(P)-2222] N87-14901
SYSTEMS INTEGRATION
Spacelab Lyman Alpha-White Light Coronagraph Program
[NASA-CR-177902] N87-14674
SYSTEMS SIMULATION
A simulated instrument, serial bus system — aircraft instruments
[LM/TR/654/2/2] N87-14329
Forced motion on spinning test for slosh-moment investigations — spacecraft stability N87-14406
SYSTEMS STABILITY
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946
SYSTOLIC ARRAYS
A survey of algorithms for integrating wafer-scale systolic arrays
[AD-A171623] N87-14602

T

T TAURI STARS
Spectral evolution of young stellar objects N87-15066
TABLES (DATA)
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
TAKEOFF
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982
[NASA-TM-88007] N87-14305
Survey of track keeping and altitudes on Heathrow and Gatwick Standard Instrument Departure routes — London airports
[CAA-PAPER-84018] N87-14308
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
TANTALUM CARBIDES
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984
TARGET RECOGNITION
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577
Visual sensitivities and discriminations and their roles in aviation
[AD-A170418] N87-14849
TARGETS
Visual sensitivities and discriminations and their roles in aviation
[AD-A170418] N87-14849
TASKS
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
TECHNOLOGICAL FORECASTING
Development of transmission facilities for electronic media in the Netherlands
[EUT-86-E-158] N87-14585
TECHNOLOGY ASSESSMENT
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
Combined spacecraft propulsion systems
[ETN-87-98864] N87-14431
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary
[ESA-CR(P)-2215] N87-14769
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771
TECHNOLOGY UTILIZATION
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407
Inertial fusion power for space applications
[DE86-011879] N87-14969
TEFLON (TRADEMARK)
Studies of erosion of solar max samples of Kapton and Teflon N87-14384
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Teflon, Kapton surface and bulk effects N87-14390
Analysis of normal and transparent silver Teflon N87-14391
Degradation studies of SMRM Teflon N87-14392
Solar maximum thermal surface assessment N87-14393
TELECOMMUNICATION
Modeling of telecommunication systems operated with advanced capacity reservation
[ENST-86E006] N87-14586
Portable operating systems for network computers: Distributed operating systems support for group communications
[AD-A170113] N87-14905
Unique coupler evaluation techniques and results
[DE86-012101] N87-14982
TELEMETRY
Packet telemetry — Spacecraft data
[MATRA-RF/176/0898-ISSUE-1-REV.] N87-14371
TELEPHONY
Development of transmission facilities for electronic media in the Netherlands
[EUT-86-E-158] N87-14585
TELESCOPES
Spacecraft subsystem support structure
[AD-D012437] N87-14576
FUSE/Lyman grant
[NASA-CR-180024] N87-14972
TELEVISION RECEIVERS
Automatic picture transmission receivers for weather satellite images. A brief introduction and survey of some commercially-available equipment
[AD-A170359] N87-14574
TELEVISION RECEPTION
Design of filters for the vertical subsampling of color difference signals at half the sampling rate — color television
[FI-447-TB-19] N87-14587
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14613
TELEVISION SYSTEMS
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980
TEMPERATURE CONTROL
Monodisperse droplet streams and their application in space — spacecraft waste heat rejection N87-14407
Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170838] N87-14651
An introduction to heat tracing
[AD-A170877] N87-14653
TEMPERATURE DEPENDENCE
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[ESA-TT-980] N87-14994
TEMPERATURE DISTRIBUTION
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
TEMPERATURE EFFECTS
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
TEMPERATURE MEASUREMENT
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
Measurement of the velocity and temperature of ignition gas and the role of the particles in the ignition mechanism
[ISL-CO-241/85] N87-14479
Measurement of the velocity and temperature of ignition gas jets in a bed of confined inert powder
[ISL-CO-245/85] N87-14480
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826
TEMPERATURE MEASURING INSTRUMENTS
Flame diagnosis using coherent anti-Stokes Raman scattering (CARS) N87-14336
TEMPERATURE PROFILES
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806
TENSILE PROPERTIES
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527
TENSILE STRENGTH
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879
TENSILE TESTS
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
TERRAIN ANALYSIS
Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
TEST FACILITIES
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852
TEST STANDS
Device for quick changeover between wind tunnel force and pressure testing
[NASA-CASE-LAR-13512-1] N87-14675
TETHERING
Balloon instrumentation engineering and development
[AD-A170225] N87-14678
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832
TEXTURES
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
THEMATIC MAPPING
Remote sensing for advanced land applications — ESA programs
[ESA-SP-1075] N87-14770
THEORETICAL PHYSICS
Cosmic superstrings and related topics
[DE86-702738] N87-15133
THERMAL CONDUCTIVITY
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007
THERMAL CYCLING TESTS
The cyclic stress-strain behavior of PWA 1480 at 650 deg C
[NASA-TM-87311] N87-14483
THERMAL DIFFUSION
Thermal extraction of krypton in aluminum using a mass spectrometer N87-14462
THERMAL DISSOCIATION
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
THERMAL EXPANSION
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535
THERMAL INSULATION
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
A preliminary report on the study of the impact sites and particles of the solar maximum satellite thermal blanket N87-14387
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Teflon, Kapton surface and bulk effects N87-14390
Solar maximum thermal surface assessment N87-14393

The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414
Ceramic-ceramic shell tile thermal protection system and method thereof
[NASA-CASE-ARC-11641-1] N87-14442
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests
[NASA-TM-88821] N87-14487
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778

THERMAL PROTECTION
Results of examination of materials from the solar maximum recovery mission N87-14383

THERMAL RESISTANCE
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984

THERMOCHEMISTRY
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539

THERMOCLINES
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826

THERMODYNAMIC EQUILIBRIUM
Size-density relations in dark clouds: Non-LTE effects N87-15068

THERMODYNAMICS
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys
[AD-A170136] N87-14491
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814

THERMOELASTICITY
Thermographic investigation on the thermoelastic effect in metals
[DE86-702986] N87-14501
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756

THERMOGRAPHY
Thermographic investigation on the thermoelastic effect in metals
[DE86-702986] N87-14501
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741

THERMOHYDRAULICS
Thermohydraulics during venting of two-phase systems N87-14551

THERMOPLASTIC RESINS
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535

THICK PLATES
Hot forming of thick plates
[CETIM-13-J-122] N87-14505

THIN FILMS
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14489
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985
Novel Si-based materials and device structures by molecular beam epitaxy
[AD-A170061] N87-15009
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016

THIN PLATES
Study of the Ti 15-3-3 titanium alloy in thin plate form
[SNIAS-45-656] N87-14510

THIN WALLED SHELLS
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350

THREE DIMENSIONAL BOUNDARY LAYER
Experimental investigations on the stability and transition of three-dimensional boundary layers
[DFVLR-FB-86-24] N87-14664

THREE DIMENSIONAL FLOW
Three-dimensional potential flow simulations for transonic inlets N87-14255
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Computational study of three-dimensional wake structure N87-14272
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Interferometry — of spatial flows N87-14332
A three dimensional viscous vortex N87-14833
Modeling three dimensional vortex flow in aerodynamics N87-14836
Study of double exposure holography of the 3-dimensional character of the flow around an airfoil profile in a wind tunnel
[NASA-TM-88486] N87-14673

THREE DIMENSIONAL MOTION
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

THRUST AUGMENTATION
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425

THRUST REVERSAL
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645

THRUST VECTOR CONTROL
High- and low-thrust propulsion systems for the space station
[NASA-TM-88877] N87-14427
An analytical and experimental investigation of resistojet plumes
[NASA-TM-88852] N87-14428
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

THUNDERSTORMS
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814

TILES
Ceramic-ceramic shell tile thermal protection system and method thereof
[NASA-CASE-ARC-11641-1] N87-14442

TIME
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963

TIME DEPENDENCE
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115

TIME DIVISION MULTIPLE ACCESS
Adaptive TDMA as a means of trading power against bandwidth — satellite tranemission N87-14583

TIME LAG
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908

TIME MARCHING
Implicit time-marching methods for the transonic Euler equations N87-14254
Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645

TIME SERIES ANALYSIS
Time series prediction of hurricane landfall
[AD-A170742] N87-14815
A fast graphical goodness of fit test for time series models
[AD-A170094] N87-14919
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942
Model for describing probability distributions in chains of events
[FOA-C-20619-2.6(2.7)] N87-14947
Binary time series with reward. Application to climatology modeling
[ETN-87-98588] N87-14950

TIME SHARING
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908

TITANATES
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015089] N87-14532

TITANIUM
Electrochemical behavior of a titanium electrode in hydrazine solutions
[NASA-TM-88538] N87-14464

TITANIUM ALLOYS
Study of the Ti 15-3-3 titanium alloy in thin plate form
[SNIAS-45-656] N87-14510

TITANIUM CARBIDES
Ionic deposits
[CETIM-12-F-362] N87-14504

TITANIUM NITRIDES
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines — glass fiber reinforced plastics; extrusion
[CETIM-12-B-162] N87-14445

TOLERANCES (PHYSIOLOGY)
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830

TOMOGRAPHY
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981

TOOLS
In situ repair of a failed compression fitting
[DE86-013682] N87-14707
Tools for high velocity surface milling of steels
[CETIM-106030] N87-14710

TORQUEMETERS
Study and implementation of torque wrench calibrating apparatus
[CETIM-103-480] N87-14679

TOXIC HAZARDS
Transport of toxic material in aerosol phase N87-14547

TOXICITY
Cables and fire hazards
[NASA-TM-88493] N87-14553

TOXICITY AND SAFETY HAZARD
Two Phase Flows in Major Technological Hazards, volume 2 — conference
[VKI-LS-1986-03-VOL-2] N87-14544

TRACE CONTAMINANTS
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829

TRACE ELEMENTS
Optimization of spectrographic trace analysis N87-14455
Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456
A comparison of trace element analysis of whole coal by INAA and XRFS — instrument neutron activation analysis (INAA); X-ray fluorescence spectroscopy (XRFS) N87-14460

TRACKING (POSITION)
Autonomous vehicle navigation
[AD-A170379] N87-14311
Time series prediction of hurricane landfall
[AD-A170742] N87-14815

TRAJECTORIES
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415

TRAJECTORY ANALYSIS
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

TRAJECTORY CONTROL
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

TRANSATMOSPHERIC VEHICLES
An overview of the British Aerospace HOTOL transatmospheric vehicle
[NASA-TM-88008] N87-14317
TRANSFORMATIONS (MATHEMATICS)
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-98587] N87-14931
Stationary Markov sets
[AD-A170109] N87-14938
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942
TRANSIENT LOADS
Magnitude equivalence of random loads and superposition with transient excitations — spacecraft payloads
[TR-5.338] N87-14418
TRANSIENT OSCILLATIONS
Magnitude equivalence of random loads and superposition with transient excitations — spacecraft payloads
[TR-5.338] N87-14418
TRANSIENT RESPONSE
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743
TRANSISTOR LOGIC
Development of a planar heterojunction bipolar transistor for very high speed logic
[AD-A170063] N87-15010
TRANSISTORS
Methodology verification of hierarchically described VLSI circuits
[AD-A171742] N87-14805
Verification and modification of the dc MOS-transitor model of Poorter
[E-EEA/323/10/1984] N87-15020
TRANSMISSION LINES
Pulse shaping with transmission lines
[DE86-013674] N87-14808
TRANSONIC COMPRESSORS
Transonic and supersonic compressors N87-14344
TRANSONIC FLOW
Implicit time-marching methods for the transonic Euler equations N87-14254
An easily vectorizable numerical solution of the Euler equations N87-14258
Transonic wing and airfoil design using inverse code WINDES N87-14275
Application of computational aerodynamics to wing design under fuselage interference N87-14276
Shock oscillations in transonic nozzle flows
[MPIS-7/1986] N87-14294
Noise development in transonic flows at the impact of vortices on a profile leading edge
[MPIS-5/1986] N87-14960
TRANSPARENCE
Analysis of normal and transparent silver Teflon N87-14391
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979
TRANSPIRATION
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292
TRANSPORT AIRCRAFT
Reliability of in-service inspection of transport aircraft structures
[CAA-PAPER-85013] N87-14244
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment, volume 1
[DOT/FAA/CT-86/25-1] N87-14306
Computer simulation of a transport aircraft seat and occupant(s) in a crash environment. Volume 2: Program SOM-TA user manual
[DOT/FAA/CT-86/25-2] N87-14307
Development of a technology for increasing payload of existing aircraft (NEW 2)
[BMFT-FB-W-86-007] N87-14328
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353
TRANSPORT PROPERTIES
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
TRANSPORT THEORY
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495
TRAPPED PARTICLES
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
TRAPPING
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
TRIANGULATION
German-Austrian stellar triangulation project using balloon sondes
[SER-B-278] N87-14758
German-Austrian stellar triangulation project using balloon sondes. Development and purpose of the project N87-14759
German-Austrian stellar triangulation project using balloon sondes. Engineering and observations N87-14760
German-Austrian stellar triangulation project using balloon sondes. Evaluation of observations and analysis of the results N87-14761
An extended mathematical model of aerotriangulation for highly precise point determination
[SER-C-316] N87-14762
TRIBOLOGY
European science notes, volume 40, number 11/12
[AD-A173371] N87-15158
TROPOSPHERE
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808
TRUSSES
Synchronously deployable double fold beam and planar truss structure
[NASA-CASE-LAR-13490-1] N87-14413
TUNABLE LASERS
Laser physics and laser techniques
[AD-A171949] N87-14697
TUNGSTEN CARBIDES
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984
TURBINE BLADES
Compressible flow analysis in turbomachinery N87-14256
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
Partial cavitation on pump blades N87-14401
Developments in blade shape design for a Darrieus vertical axis wind turbine
[DE86-016056] N87-14774
TURBINE PUMPS
Fluid dynamic problems in the HM60 (Vulcain) cryogenic turbopump — Ariane 5 N87-14399
Aerodynamic design and test of a supersonic turbine for a rocket engine — Ariane 5 N87-14400
TURBINE WHEELS
Instationary flow effects in the rotor of a turbine
[ESA-TT-1001] N87-14663
TURBINES
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
TURBOCOMPRESSORS
Effect of Reynolds number on turbomachines N87-14346
TURBOFAN ENGINES
Scaled centrifugal compressor program
[NASA-CR-174912] N87-14349
TURBOMACHINERY
Computation of flow through multistage turbomachines taking into account flow losses and heat fluxes N87-14347
TURBULENCE
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
Jeans criterion in a turbulent medium N87-15065
TURBULENCE EFFECTS
Turbulent vortices N87-14634
TURBULENT BOUNDARY LAYER
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
Measurements of the low-wave-number structure of a turbulent boundary layer
[IC-AERO-85-01] N87-14657
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14661
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convetional meteorological variables
[AD-A169478] N87-14808
TURBULENT FLOW
Effects of boundary conditions in numerical experiments for turbulent flows N87-14265
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients
[NASA-TM-88490] N87-14281
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292
Measurement of pressure fluctuations on the wall of a turbulent combustion furnace
[ONERA-RTS-47/7104-EY] N87-14478
Turbulent vortices N87-14634
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648
Measurements of the low-wave-number structure of a turbulent boundary layer
[IC-AERO-85-01] N87-14657
Numerical simulation of turbulent structures in a mixing zone
[ETN-87-98582] N87-14660
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
TURBULENT JETS
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648
TURBULENT MIXING
Numerical simulation of turbulent structures in a mixing zone
[ETN-87-98582] N87-14660
TURBULENT WAKES
Investigations of the wake in a flow parallel to plates with blunt trailing edges
[MPIS-3/1986] N87-14293
Numerical simulation of vortical flow N87-14640
TWO DIMENSIONAL FLOW
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-989] N87-14295
Numerical simulation of turbulent structures in a mixing zone
[ETN-87-98582] N87-14660
Criteria for separation in two-dimensional steady and unsteady compressible flow
[ESA-TT-985] N87-14668
TWO PHASE FLOW
Two Phase Flows in Major Technological Hazards, volume 2 — conference
[VKI-LS-1986-03-VOL-2] N87-14544
Discharges of saturated liquefied gases from pressure vessels N87-14545
Formation and dynamics of aerosols N87-14546
Transport of toxic material in aerosol phase N87-14547
Stratification phenomena and associated hazards N87-14549
Thermohydraulics during venting of two-phase systems N87-14551
Two-phase flow through safety devices and valves N87-14552

U

ULTRAHIGH FREQUENCIES
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
ULTRASONIC FLAW DETECTION
Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720
Fault detection sensitivity in thick light alloy specimens, test report
[REPT-47-084/F] N87-14721

Results of the tests carried out to study the physical parameters affecting the ultrasonic inspection made by transmission under water jet (SIRO), part 1
[I-114/85-PT-1] N87-14723
Ultrasonic fatigue studies of short and long surface cracks
[FFA-TN-1986-44] N87-14746
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756

ULTRASONIC RADIATION
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794

ULTRASONIC SCANNERS
Results of the tests carried out to study the physical parameters affecting ultrasonic inspection made by transmission under water jets (SIRO), part 2
[I-126/85-PT-2] N87-14724

ULTRASONIC SPECTROSCOPY
A method and a device to determine the crack depth of surface cracks
[BLL-TRANS-AAEC-798-(1797.43)] N87-14728

ULTRASONIC TESTS
Ultrasonic inspection of hinge support number 5 — A-320 aircraft components
[I-129/85] N87-14725

ULTRASONICS
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726
The application of ultrasonic attenuation spectral analysis to materials characterisation
[AERE-R-11885] N87-14755
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170062] N87-14794

ULTRAVIOLET RADIATION
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042

ULTRAVIOLET SPECTRA
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112

UNDERWATER EXPLOSIONS
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646

UNDERWATER TESTS
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-528] N87-14304

UNITED STATES
Updated wind energy resource assessment of the US
[DE86-015788] N87-14773

UNIVERSE
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132

UNSTEADY FLOW
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341
Instationary flow effects in the rotor of a turbine
[ESA-TT-1001] N87-14663

UPLINKING
Uplink power control of satellite Earth stations as a fade-countermeasure of 20/30 GHz communication systems N87-14564

USER MANUALS (COMPUTER PROGRAMS)
SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide
[NLR-TR-84128-U] N87-14288
User's introductory guide (HM-256)
[DE86-013002] N87-14886
NUMVEC FORTRAN library manual. Chapter: Simultaneous linear equations
[CWI-NM-R8614] N87-14896
Eindhoven Schematic Editor (ESCHER) reference manual — electric circuit design
[EUT-86-E-157] N87-14897
NUMVEC FORTRAN library manual. Chapter: Parabolic Partial Differential Equations (PDEs). Routine: Backward differentiation multigrid (BDMG)
[CWI-NM-R8610] N87-14927

USER REQUIREMENTS
A user-oriented performance index for packet switched networks
[AD-A168903] N87-14570
Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589

V

VACUUM
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521

VACUUM CHAMBERS
Research on a new type of negative hydrogen ion source
[AD-A170068] N87-14985

VALLEYS
Forcing mechanisms of mountain-valley circulations in the Inn-Valley (Alps)
[DFVLR-FB-86-28] N87-14802

VALVES
Balloon instrumentation engineering and development
[AD-A170225] N87-14678

VAPOR DEPOSITION
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
Ionic deposits
[CETIM-12-F-362] N87-14504

VAPOR PHASES
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123

VARIABILITY
Parameterization of overwater horizontal wind variability
[AD-A169331] N87-14807

VARIATIONAL PRINCIPLES
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743

VECTOR ANALYSIS
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14893

VECTORS (MATHEMATICS)
Studies of radiative transfer in planetary atmospheres
[NASA-CR-180021] N87-15149

VEGETATIVE INDEX
Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data
[INPE-4035-RPE/522] N87-14764

VELOCITY
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757

VELOCITY DISTRIBUTION
The velocity dispersion of the giant molecule clouds: A viscous origin N87-15091

VELOCITY ERRORS
Calibration of ETS videotapes
[AD-A168888] N87-14677

VELOCITY MEASUREMENT
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
Measurement of the velocity and temperature of ignition gas and the role of the particles in the ignition mechanism
[ISL-CO-241/85] N87-14479
Measurement of the velocity and temperature of ignition gas jets in a bed of confined inert powder
[ISL-CO-245/85] N87-14480
PNS (Parabolized Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647
Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173086] N87-14698

VELOCITY MODULATION
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14613

VENTING
Thermohydraulics during venting of two-phase systems N87-14551

VENUS (PLANET)
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets
[NASA-TM-88532] N87-15140
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145
Parquet: Regions of areal plastic dislocations (on Venus)
[NASA-TM-88510] N87-15147

VENUS SURFACE
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21)
[NASA-TM-88494] N87-15139
Structural ensembles of the north belt of Venus deformations and possible mechanisms of their formation
[NASA-TM-88511] N87-15141
Geological-morphological description of the Ishtar Terra (photomap of the Venusian surface sheet B-5)
[NASA-TM-88497] N87-15143
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus
[NASA-TM-88507] N87-15144
Straas on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16
[NASA-TM-88509] N87-15146
Parquet: Regions of areal plastic dislocations (on Venus)
[NASA-TM-88510] N87-15147

VERTICAL ORIENTATION
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646

VERTICAL TAKEOFF AIRCRAFT
DOD (Department of Defense) acquisition: Case study of the Navy V-22 OSPREY Joint Vertical Lift Aircraft Program
[PB86-231388] N87-14315

VERY HIGH FREQUENCY RADIO EQUIPMENT
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312

VERY LARGE SCALE INTEGRATION
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
Method of examining microcircuit patterns
[NASA-CASE-NPO-16299-1] N87-14594
Methodology verification of hierarchically described VLSI circuits
[AD-A171742] N87-14605
Design of Programmable Logic Arrays (PLA) CMOS
[ETN-87-98590] N87-14617
Contribution to the study of a monolithic 32 bit processor in CMOS technology
[ETN-87-98592] N87-14618
MOS circuit models in network C
[AD-A169951] N87-14876
Coordinate free LAP
[AD-A169982] N87-14877

VERY LONG BASE INTERFEROMETRY
Delay estimation in digital correlation interferometers with special consideration of the MK 2 system of the Max-Planck Institute of Radio Astronomy
[REPT-68] N87-15038
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054

VESTS
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856

VHF OMNIRANGE NAVIGATION
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312

VIABILITY
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834

VIBRATION
Analysis of shock and vibration environments for cargo on C9B transport aircraft
[DE86-016101] N87-14322
Activities report of the Institute of Sound and Vibration Research
[ETN-86-98365] N87-14745

VIBRATION DAMPING
Adaptive inverse control for rotorcraft vibration reduction
[NASA-TM-86829] N87-14910
VIBRATION EFFECTS
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859
VIBRATION MEASUREMENT
Emitted vibration measurement device and method
[NASA-CASE-MFS-25981-1] N87-14670
A low-cost optical data acquisition system for vibration measurement
[NASA-TM-88907] N87-14730
VIBRATION SIMULATORS
The deduction of bearing forces in rotating machinery — ship machinery
[BR99658] N87-14372
VIBRATIONAL SPECTRA
Relaxation of vibrational degrees of freedom N87-14335
Studies of interstellar vibrationally-excited molecules N87-15119
VIDEO DATA
A noise reduction system for video signals with a low signal to noise ratio
[ETN-86-98720] N87-14614
Calibration of ETS videotapes
[AD-A168888] N87-14677
VIEWING
Double window viewing chamber assembly
[NASA-CASE-MFS-28057-1] N87-14355
VIRUSES
Some evidence on non-transmissibility of acute upper respiratory disease and related matters
[PREPRINT-115] N87-14842
VISCOSITY
The velocity dispersion of the giant molecule clouds: A viscous origin N87-15091
VISCOUS FLOW
Transonic aileron computation in comparison to wind tunnel test N87-14273
Computation of flow through multistage turbomachines taking into account flow losses and heat fluxes N87-14347
A three dimensional viscous vortex N87-14633
VISIBILITY
Visibility of signal lights under atmospheric effects
[ESA-TT-987] N87-14992
VISION
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
VISUAL DISCRIMINATION
Reliability of in-service inspection of transport aircraft structures
[CAA-PAPER-85013] N87-14244
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695
Visual sensitivities and discriminations and their roles in aviation
[AD-A170418] N87-14849
VISUAL FIELDS
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
VISUAL PERCEPTION
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847
VISUAL SIGNALS
Visibility of signal lights under atmospheric effects
[ESA-TT-987] N87-14992
VISUAL STIMULI
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837
VOIDS
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503
VOLCANOES
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus
[NASA-TM-88508] N87-15145
VOLUME
Nicad battery packages
[AD-A170140] N87-14598
VORTEX BREAKDOWN
Vortex breakdown in technology and nature N87-14638
Vortex breakdown theories N87-14639
VORTEX RINGS
Geophysical vortices and vortex rings N87-14635
VORTEX SHEDDING
Vortex breakdown in technology and nature N87-14638
VORTICES
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
Computational study of three-dimensional wake structure N87-14272
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients
[NASA-TM-88490] N87-14281
Introduction to Vortex Dynamics, volume 1 — conference
[VKI-LS-1986-08-VOL-1] N87-14630
Fundamentals of vortex motion N87-14631
Review of vortex flows N87-14632
A three dimensional viscous vortex N87-14633
Turbulent vortices N87-14634
Geophysical vortices and vortex rings N87-14635
Modeling three dimensional vortex flow in aerodynamics N87-14636
Introduction to Vortex Dynamics, volume 2 — conference
[VKI-LS-1986-VOL-2] N87-14637
Vortex breakdown in technology and nature N87-14638
Numerical simulation of vortical flow N87-14640
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
Noise development in transonic flows at the impact of vortices on a profile leading edge
[MPIS-5/1986] N87-14960
VORTICITY EQUATIONS
Fundamentals of vortex motion N87-14631
Review of vortex flows N87-14632
Numerical simulation of vortical flow N87-14640

W

WAFERS
A survey of algorithms for integrating wafer-scale systolic arrays
[AD-A171623] N87-14602
Report on an interlaboratory electromigration experiment
[AD-A169652] N87-15006
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016
WAKES
Computational study of three-dimensional wake structure N87-14272
WALL FLOW
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-989] N87-14295
WALL PRESSURE
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655
WALLS
Implicit time-marching methods for the transonic Euler equations N87-14254
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
WARNING SYSTEMS
Auditory warnings on the BAC 1-11 and the Boeing 747. An application of the guidelines of CAA Paper 82017
[CAA-PAPER-85004] N87-14303
WASHING
Development and testing of a washing process for exhaust gas of stationary operated internal combustion engines
[BMFT-FB-T-86-011] N87-14708
WASTE DISPOSAL
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829
WASTE ENERGY UTILIZATION
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425
WATER FLOW
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646
WATER HEATING
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778
WATER PRESSURE
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646
WAVE EQUATIONS
Limiting behavior of linearly damped hyperbolic equations
[AD-A170161] N87-14920
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations
[AD-A170187] N87-14921
WAVE EXCITATION
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
WAVE PROPAGATION
Propagation of sound waves in tubes of noncircular cross section
[NASA-TP-2601] N87-14284
A computer simulation of detonation within an energetic molecular crystal
[AD-A171662] N87-14472
Double reference pulsed phase locked loop
[NASA-CASE-LAR-13310-1] N87-14559
Nonlinear wave propagation study
[AD-A170201] N87-14572
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
Solar-geophysical data number 502, June 1986. Part 1: (Prompt reports). Data for May 1986, April 1986 and late data
[PB86-224011] N87-14803
Finite element modeling of electromagnetic propagation in composite structures
[NASA-TM-88916] N87-14956
Experimental evidence of MHD surface wave
[ISSN-0469-4732] N87-14997
WAVEGUIDE LASERS
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693
WEAPON SYSTEMS
Strategic defense initiative and the prospects for international cooperation in space
[DE86-016153] N87-15029
WEAR
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524
WEATHER
World weather extremes: Revision
[AD-A170138] N87-14810
WEATHER FORECASTING
Remote detection of aircraft icing conditions using microwave radiometers
[PB86-229507] N87-14806
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811
Time series prediction of hurricane landfall
[AD-A170742] N87-14815
WEIGHT MEASUREMENT
Helicopter passenger weigh survey, conducted at Aberdeen Airport, November 1984
[CAA-PAPER-85005] N87-14853
WEIGHT REDUCTION
Evaluation of low density mirror blanks for space observatories
[SIRA-A/7123/00] N87-14987
WEIGHTLESSNESS
Observations on behavior of liquid in weightlessness N87-14408
WELD TESTS
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
Pulsed MIG welding, text
[ETN-87-98699] N87-14716
WELDED STRUCTURES
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714
WELDING
Materials science in Europe
[AD-A170214] N87-14435

The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operaters are being subjected
[MOD-103/86] N87-14783

WELDING MACHINES
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
Pulsed MIG welding, text
[ETN-87-98699] N87-14716

WEST GERMANY
Extraterrestrial research in the Federal Republic of Germany
[NASA-TM-88010] N87-14358
Development of Test Reference Years (TRY) for climatic regions in the Federal Republic of Germany
[BMFT-FB-T-86-051] N87-14818

WHISKERS (CRYSTALS)
Carbon whisker study
[AD-A170345] N87-15012

WHITE DWARF STARS
Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs
[DE86-016168] N87-15135

WIDTH
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-526] N87-14304

WIGGLER MAGNETS
Two-stage FEL (Free Electron Laser) research at KMS Fusion, Inc.
[AD-A170828] N87-14696

WIND (METEOROLOGY)
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814

WIND MEASUREMENT
Forcing mechanisms of mountain-valley circulations in the Inn-Valley (Alps)
[DFVLR-FB-86-28] N87-14802

WIND SHEAR
Wind shear and flight safety: A select bibliography
[CAA-PAPER-86003] N87-14300
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353

WIND TUNNEL APPARATUS
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290

WIND TUNNEL MODELS
A method for the manufacture of model helicopter rotor blades from glass fiber reinforced plastic
[RAE-TR-85040] N87-14316

WIND TUNNEL TESTS
Transonic aileron computation in comparison to wind tunnel test N87-14273
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients
[NASA-TM-88490] N87-14281
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290
Experience about the application and valuation of roughness strips for boundary layer transition control in wind tunnel tests in the high-speed range
[DFVLR-MITT-86-12] N87-14291
Laboratory simulation of the real gas effects of reentry N87-14396
Study of double exposure holography of the 3-dimensional character of the flow around an airfoil profile in a wind tunnel
[NASA-TM-88486] N87-14673
Device for quick changeover between wind tunnel force and pressure testing
[NASA-CASE-LAR-13512-1] N87-14675

WIND TUNNEL WALLS
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-969] N87-14295

WIND TURBINES
Developments in blade shape design for a Darrieus vertical axis wind turbine
[DE86-016056] N87-14774

WIND VARIATIONS
Parameterization of overwater horizontal wind variability
[AD-A169331] N87-14807

WIND VELOCITY
Field study of wind through and over a forest edge
[AD-A169491] N87-14809

WINDOWS (APERTURES)
Double window viewing chamber assembly
[NASA-CASE-MFS-28057-1] N87-14355
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786

WINDPOWER UTILIZATION
Updated wind energy resource assessment of the US
[DE86-015788] N87-14773

WING PLANFORMS
Compressibility effects on flows around simple components N87-14642

WING PROFILES
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-98436] N87-14287

WINGS
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
Direct numerical control in grid generation N87-14270
Transonic wing and airfoil design using inverse code WINDES N87-14275
Remote pivot decoupler pylon: Wing/store flutter suppressor
[NASA-CASE-LAR-13173-1] N87-14314
Modeling three dimensional vortex flow in aerodynamics N87-14636

WORKLOADS (PSYCHOPHYSIOLOGY)
A model of typing performance with respect to mental load factors — computer operators
[DRIC-T-7770] N87-14844

WORKSTATIONS
Database oriented UNIX operating environment and its application N87-14253

WORLD METEOROLOGICAL ORGANIZATION
International list of selected, supplementary and auxiliary ships — Global Observing System
[WMO/OMM-47-ED-86] N87-14819
Composition of the WMO
[WMO/OMM-5] N87-14820

WRENCHES
Study and implementation of torque wrench calibrating apparatus
[CETIM-103-480] N87-14679

X

X RAY APPARATUS
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984

X RAY ASTRONOMY
The X-ray and gamma-ray astronomy (including non-photon astronomy)
[MPE-PREPRINT-58] N87-15039

X RAY FLUORESCENCE
A comparison of trace element analysis of whole coal by INAA and XRFS — instrument neutron activation analysis (INAA); X-ray fluorescence spectroscopy (XRFS) N87-14460

X RAY IMAGERY
Method of fabricating an imaging X-ray spectrometer
[NASA-CASE-GSC-12956-1] N87-14671

X RAY IRRADIATION
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834

X RAY SCATTERING
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115

X RAY SOURCES
Optically thin winds from neutron stars
[MPE-PREPRINT-50] N87-15154
The 35 day cycle of Her X-1: Quality of clock mechanism — X-ray binary star
[MPE-PREPRINT-54] N87-15155
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 — X-ray burster
[MPE-PREPRINT-57] N87-15156

X RAY SPECTRA
Infrared studies of supernova remnants with the IRAS N87-15104

X RAY SPECTROSCOPY
Method of fabricating an imaging X-ray spectrometer
[NASA-CASE-GSC-12956-1] N87-14671

X RAY STRESS MEASUREMENT
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441

X RAYS
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985

Y

YAG LASERS
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691

YTTRIUM OXIDES
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979

Z

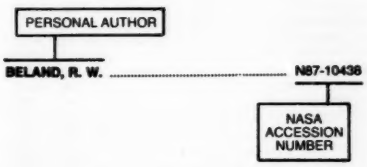
ZEEMAN EFFECT
Zeeman Laser Scattering (ZLS): A new light scattering technique
[DE86-012443] N87-14700

ZINC COMPOUNDS
The performance of zinc phosphate two-pack epoxy primers
[MQAD-TP-917] N87-14514
High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

ZIRCONIUM
Nickel base coating alloy
[NASA-CASE-LEW-13834-1] N87-14482

ZIRCONIUM OXIDES
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests
[NASA-TM-88821] N87-14487
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABRAMOF, E. N87-15005
ABSHIRE, J. B. N87-14687
ACKERMANN, M. R. N87-14417
ACOSTA, R. N87-14569
ADAMS, F. C. N87-15066
AKDENIZ, K. G. N87-15132
AKI, T. N87-14252
AKISHITA, S. N87-14261
ALBANO, G. N87-14399
ALBE, E. N87-14680
ALCORN, G. E. N87-14671
ALEKSANDROV, Y. N. N87-15143
ALFANO, R. R. N87-14691
ALFANO, S. N87-14370
ALFVEN, H. N87-15136
ALGERMISSEN, J. N87-14338
N87-14343
ALLAMANDOLA, L. J. N87-15075
N87-15101
ALLAN, J. R. N87-14304
ALLEGRE, J. N87-14404
ALLEN, M. M. N87-15122
ALLER, L. H. N87-15076
ALLSOP, D. P. N87-14329
ALSTON, W. B. N87-14432
N87-14433
ALTPETER, E. N87-14506
ALY, M. M. N87-14459
AMAGISHI, Y. N87-14997
AMECKE, J. N87-14295
ANDERS, K. N87-14407
ANDERS, K. P. N87-14958
ANDERSON, R. N87-14885
ANDO, S. N87-14262
ANTONIAZZI, L. N87-14756
APEL, J. N87-14797
APONSO, B. L. N87-14351
ARAKAWA, H. N87-14274
ARESO, M. A. N87-14535
ARGUEELLO, G. N87-14959
ARNBAK, J. C. N87-14585
ARNOLD, C. N87-14901
ARNOLD, G. S. N87-14449
ARROS, S. C. N87-14852
ARTERO, J. C. N87-14880
ASCHENBACH, B. N87-15039
ASHARY, A. N87-14523
ASHBY, M. F. N87-14727
ASHWILL, T. D. N87-14774
ATHANS, M. N87-14580
ATKINSON, H. V. N87-15021
ATMANSPACHER, H. N87-14684
N87-14685
ATMANSPACHNER, H. N87-14686
AUBERTIN, J. M. N87-14364
AUTH, H. N87-14354
AVERY, L. W. N87-15053
N87-15120
AYOUN, A. N87-14364

B

BAAN, W. N87-15095
BACA, T. J. N87-14322
BAER, E. N87-14522
BAIN, I. L. N87-14605
BAINTON, K. F. N87-14726
BAKER, B. B. N87-14650
BALBUS, S. A. N87-15092
BALL, R. N87-15077
BALLET, J. N87-15073
BALLY, J. N87-15058
N87-15071
N87-15078
N87-15082
BANDEIRA, I. N. N87-15005
BARBOSA, A. N87-14727
BARGERON, C. B. N87-14384
BARKER, A. J. N87-14987
BARKER, L. N87-14425
BARRE, P. R. N87-14312
BARRETT, C. A. N87-14482
N87-14488
BARTLO, J. A. N87-14808
BARTON, J. N87-14303
BARTON, S. K. N87-14563
BARTOSCH, C. E. N87-14964
BASHFORD, D. P. N87-14246
BATTRICK, B. N87-14770
BAUDENISTEL, E. N87-14948
BAUER, B. N87-14339
BAUER, M. N87-14888
BAUER, W. N87-15003
BAUMEISTER, K. J. N87-14956
BAUR, G. N87-14988
BAZELL, D. N87-15087
BAZILEVSKIY, A. T. N87-15145
BECKERS, A. L. D. N87-14932
N87-14991
BECKETT, W. N87-14876
N87-14877
BEGELMAN, M. C. N87-15084
BEICHMAN, C. A. N87-15061
BEIG, H. G. N87-14410
BELENKIY, Y. G. N87-15140
BELESKY, R. M. N87-14792
BELJAARS, J. W. F. M. N87-14712
BENNERHULT, O. N87-14418
BENSON, P. J. N87-15061
BENSON, R. C. N87-14384
BERETTA, G. N87-14553
BERGSTRA, J. A. N87-14894
N87-14895
BERI, A. C. N87-14471
BERKOVITS, A. N87-14489
BERNARDO, J. M. N87-14723
BERNEGGER, S. N87-14787
BERRY, W. N87-14402
BESKE, H. E. N87-14454
BEYER, W. K. G. N87-15038
BHATT, R. T. N87-14517
BIERBAUM, V. M. N87-14796
BINDER, A. N87-14663
BIRKS, A. R. N87-14769
BISCHOFF, K. N87-14989
BLACK, D. C. N87-15128
BLACK, J. N87-15078
BLACK, J. H. N87-15117
BLACKWELL, J. H. N87-15051
BLAIZOT, J. N87-14510
BLANC, A. N87-14371
BLOCK, J. N87-14437
N87-14440
BLOM, A. F. N87-14746
N87-14747
BLOOD, B. D. N87-14861
BLUEMEL, K. N87-14818
BOBINA, N. N. N87-15139
BODE, J. N87-14993
BOEHME, W. N87-14749
BOETTCHER, R. D. N87-14403
BOGDANOVICH, V. B. N87-14464
BOHDANSKY, J. N87-15003
BOHREN, C. F. N87-14978
BOLUKBASI, A. O. N87-14306
N87-14307
BONANNI, P. G. N87-14568
BONAZZOLA, S. N87-15065
BONNEFOUS, S. G. C. N87-14852
BORD, C. N87-14445
BORDELON, V. P. N87-14848
BORGEFORS, G. N87-14902
BOSLOUGH, M. B. N87-14474
BOTT, J. F. N87-14688
BOUCEK, G. P., JR. N87-14330
BOULAUD, D. N87-14546
N87-14547
BOURGET, P. G. N87-14810
BOWYER, S. N87-14972
BOYD, A. D. N87-14472
BRADSHAW, P. N87-14657
BRAIG, W. N87-14347
BRAUN, A. N87-15154
BREGMAN, J. D. N87-15075
N87-15101
BREUT, J. N87-14679
BREYLEY, L. R. N87-14428
BRIERRE, M. N87-14445
BRINKMANN, W. N87-15154
BROOKER, P. N87-14780
N87-14781
BROPHY, J. J. N87-14525
BROWN, G. V. N87-14730
BRZEZOWSKI, S. J. N87-14766
BUCHER, E. N87-14776
BUDD, T. N87-14889
BUDIANSKY, B. N87-14735
BUFTON, J. L. N87-14687
BUGEAT, J. P. N87-14429
BULAU, J. R. N87-14572
BUNTE, S. W. N87-14537
BURBA, G. A. N87-15139
BURESCH, O. N87-14457
BURGESS, A. S. N87-14671
BURGESS, T. W. N87-14706
BURKE, W. J. N87-14795
BURKE, W. R. N87-14394
BURLAGA, L. F. N87-15131
BURNS, J. M. N87-14361
BURNS, M. S. N87-15050
BURTON, L. C. N87-14604
BUS, E. S. N87-15130
BUSBY, W. S. N87-15042
BUSS, R. H., JR. N87-15112
BYALOBZHESKII, A. V. N87-14484
BYRNE, W. P. N87-14513
BYTHROW, P. F. N87-14795

C

CABRAL, B. N87-14887
CALDICHOURY, M. N87-14364
CAMPBELL, D. V. N87-14581
CAMPBELL, G. A. N87-15003
CAMPBELL, W. J. N87-14828
CANTO, J. N87-15052
CARGILL, G. N87-14349
CARLSTROM, J. N87-15121
CARR, J. N87-15074
CARSENTY, U. N87-15130
CASSINELLI, J. P. N87-15063
CASSINO, V. N87-14356
CASTELAZ, M. W. N87-15103
CAUSEY, R. A. N87-15003
CEDERQUIST, J. N. N87-14882
CERIC, B. N87-14463
CHALLENGER, K. D. N87-14435
CHAMBERS, A. N87-14514
CHAMPNESS, B. G. N87-14589
CHAN, K. S. N87-14493
CHANDRASEKARAN, B. N87-15025
CHANG, J. L. C. N87-14644
CHANG, R. K. N87-14698
CHANG, S. C. N87-14918

CHAO, R. N87-14942
CHARLES, D. N87-14243
CHARLIER, H. N87-14901
CHARLOT, J. J. N87-15019
CHARRETTE, E. E., III N87-14794
CHAVARRIA-K., C. N87-15069
CHEN, P. C. N87-14733
CHERRY, P. N87-14710
CHESI, G. N87-14760
N87-14761
CHRISTOPULOS, J. A. N87-14607
CHUNG, S. Y. N87-14392
CIGLEDY, R. N87-14973
CLANTON, U. S. N87-14386
CLARK, B. A. N87-14856
CLARK, B. J. N87-14957
CLARK, C. F. N87-15007
CLARK, T. L. N87-14823
CLARKE, G. P. N87-14754
CLARO, F. N87-15015
CLARY, G. R. N87-14310
CLAUDINON, B. N87-14419
CLAUS, H. H. N87-14666
CLAYTON, G. C. N87-15109
CLEMENS, D. P. N87-15090
COFFEE, T. P. N87-14467
COFFEY, H. E. N87-14803
N87-14804
COHEN, H. D. N87-14835
COHEN, M. N87-15075
COHEN, N. N87-14688
COHEN, S. C. N87-14687
COLBURN, C. W. N87-14982
COLE, D. M. N87-14554
COLEMAN, R. G. N87-14742
COLLINS, C. B. N87-14699
COLLINS, E. R., JR. N87-14704
N87-14705
CONN, R. W. N87-15003
CONNELL, S. N87-14589
COOK, M. R. N87-14835
COOPRIDER, L. N87-14878
CORBIN, N. D. N87-14521
CORNEC, A. N87-14752
COUDURIER, J. F. N87-14709
COUGHLIN, J. P. N87-14575
COUGNET, C. N87-14364
N87-14419
COUTELLE, R. N87-14708
COWAN, A. M. N87-14769
COX, J. M. N87-14513
CRANE, J. M. N87-14330
CRANFILL, F. M. N87-14652
CRIMMINS, T. R. N87-14882
CRITCHLEY, J. B. N87-14780
N87-14782
CRONIN, J. N87-15045
CRONIN, N. J. N87-15060
CROWE, A. N87-14554
CUNO, R. J. N87-14760
CURRAN, A. M. N87-14878
CURRIE, I. D. N87-14945
CURRY, T. F. N87-14815
CURTIN, M. S. N87-14696
CUSHMAN, R. N87-14954
CUTTER, M. A. N87-14987

D

DACRUZ, J. J. N87-14917
DAFT, R. N87-15026
DAIGUJI, H. N87-14254
DAINTY, A. M. N87-14794
DANBERG, J. E. N87-14285
DANDACHE, A. N87-14617
DANIELS, M. A. N87-14655
DANLY, L. N87-15088
DAS, M. P. N87-14500
DASS, W. C. N87-14879
DAVIDSON, C. A. N87-14322
DAVIDSON, D. L. N87-14493
DAVIES, N. G. N87-14565
DAVIES, T. J. N87-14986
DAVIS, L. S. N87-14311
DAVIS, R. E. N87-14375
DAVIS, T. J. N87-14310
DAYWITT, W. C. N87-14595
DECKER, M. T. N87-14806
DEDERMAN, D. A. N87-14742
DEGNAN, J. J. N87-14687
DEGOEDE, E. N87-14929
DEKERMENDJIAN, R. L. N87-14672
DEKHTYAREVA, K. I. N87-15140
DEKONING, A. U. N87-14744
DELAURIER, J. D. N87-14678
DELEEUW, J. H. N87-14678
DEMMEL, J. N87-14324
N87-14326
DENNIS, R. L. N87-14823
DESERT, F. X. N87-15087
DESFORETS, G. P. N87-15081
DESPORT, J. A. N87-14511
DETTLEFF, G. N87-14403
DEVIMEUX, J. F. N87-14709
DEWAARD, J. N87-14869
DEWIT, M. C. A. J. N87-14556
DHENDECOURT, L. N87-15098
DHOOGE, P. M. N87-14540
DIAMENT, P. N87-14696
DIAMOND, I. D. N87-14782
DIAN, R. N87-14543
DICKEL, J. R. N87-15079
DICKEY, J. M. N87-15085
DICKMAN, R. L. N87-15080
DIEKMANN, O. N87-14926
DIELTZ, J. P. N87-14861
DIMARCO, R. N87-14351
DINERSTEIN, H. L. N87-15074
DINGDING, X. N87-14286
DIPPER, M. J. N87-14646
DOGGETT, J. W. N87-14322
DONCHIN, E. N87-14838
DONMOYER, P. M. N87-14537
DONNELLY, R. F. N87-15042
DOYLE, M. A. N87-14795
DRAGOVAN, M. N87-15058
N87-15082
DREHER, J. N87-15121
DRINKWATER, M. R. N87-14769
DRUCE, S. G. N87-14512
DRUMMOND, J. N87-14785
DRUMMOND, T. J. N87-15018
DRZAL, L. T. N87-14527
DUBOIS, J. N87-14901
DUBOWICZ, P. W. N87-14581
DUFFY, D. M. N87-15021
DUNCAN, M. G. N87-14720
DUNHAM, W. D. N87-14380
DURBIN, P. A. N87-14998
DURHAM, S. D. N87-14940
DUTT, P. N87-14862
DUTTON, G. W. N87-14719
DWEK, E. N87-15104
DYSON, B. F. N87-14727

E

EAST, R. A. N87-14397
EBELING, W. N87-14339
ECKELS, P. W. N87-15007
EDWARDS, J. A. N87-14412
EDWARDS, V. N87-14609
EGGERS, H. N87-14751
EHHALT, D. H. N87-14785
N87-14788
EHLER, W. N87-14898
EILEK, J. A. N87-15079
EISENLOHR, H. N87-14293
EL-NEWEIHI, E. N87-14937
EL-SAYED, M. A. N87-14490
ELHIMDI, K. N87-14950
ELKINS, B. R. N87-14355
ELLIOTT, D. L. N87-14773
N87-14982
ELLIS, H. B., JR. N87-15048
ELLISON, G. B. N87-14796
ENGBLOM, J. J. N87-14321
ENGL, B. N87-14508
ERICKSON, M. N87-14554
ERICKSON, N. R. N87-15119
ESCALANTE, V. N87-15052
ESCUDIER, M. P. N87-14638
N87-14639
EVANS, W. J. N87-14836
EVESQUE, P. N87-14490
EWEN, R. L. N87-14424
EXTON, R. J. N87-14669
EYER, A. N87-14542

F

FACEMIRE, B. R. N87-15004
FAGOT, H. N87-14680
FALGARONE, E. N87-15065
N87-15125
FAN, H. N87-14983
FANGMEIER, R. N87-14555
FARHAT, N. H. N87-14981
FARSI, M. N87-14913
FECKE, F. J. N87-14901
FEHRENBACH, W. N87-14988
FEIGENBAUM, B. N87-14581
FEIKEN, J. J. A. N87-15020
FENG, J. N87-14492
FERLAND, G. J. N87-15035
FERREIRA, S. O. N87-15005
FGEPPERT, E. N87-14606
FIECHTER, M. N87-14281
FIENUP, J. R. N87-14882
FILHO, P. H. N87-14764
FISCHER, W. N87-14779
FLON, L. N87-14878
FLORIAN, K. N87-14455
FLOWER, D. R. N87-15081
FLURER, R. L. N87-14982
FOERSCHING, H. N87-14668
FOERSTER, K. N87-14337
N87-14341
FOO, Y. K. N87-14912
FORNASIERO, L. N87-14898
FORREST, K. M. N87-14899
FOTINO, I. A. P. N87-14806
FOX, C. J. N87-15158
FRADJ, M. N87-14870
FRANC, J. P. N87-14287
FRANKE, A. N87-14465
FRANKOWSKI, I. N87-14776
FRAZIER, D. O. N87-15004
FRECON, L. N87-14584
FRIEDEL, L. N87-14551
N87-14552
FRISTROM, R. M. N87-14384
FRITZ, I. J. N87-15018
FROHN, A. N87-14334
N87-14335
FRORIEP, R. N87-14352
FRUEHAUF, H. H. N87-14344
FRY, R. J. M. N87-14841
FUCHS, W. N87-14325
FUERSTENAU, H. N87-14994
FUJII, K. N87-14266
N87-14267
FULLER, G. A. N87-15061
FURUYA, K. N87-14462

G

GABB, T. P. N87-14483
GAIZAUSKAS, V. N87-15150
GALUSKA, A. A. N87-14391
GANSER, M. N87-14988
GARATE, E. N87-14724
N87-14725
GARCIA, A., III N87-14619
GARVIN, J. B. N87-14687
GARWOOD, R. W. N87-15085
GASIEWSKI, A. W. N87-14568
GATLEY, I. N87-15060
GAUERT, R. N87-14702
N87-14993
GAUVAIN, J. N87-14548
GEBALLE, T. R. N87-15107
GEHRZ, R. D. N87-15059
GELFAND, S. B. N87-14941
GENZEL, R. N87-15083
GEORGE, T. F. N87-14471
N87-14962
GERLA, M. N87-14579
GEROMEL, J. C. N87-14917
GEVINS, A. S. N87-14847
GIBSON, G. P. N87-14512
GILBERT, T. N87-14524
GILL, P. R. N87-14855
GILLERLAIN, J. N87-14643
GILMORE, W. E. N87-14858
GISLER, G. L. N87-14670
GLACCUM, W. N87-15113
GLASSER, L. A. N87-14605
GLEYSE, B. N87-14931
GLUCK, N. S. N87-14964
GOEBEL, D. M. N87-15003
GOETTIG, S. N87-15014
GOETTSCHING, L. N87-14340
GOLDSMITH, P. F. N87-15057
GOLDSTEIN, H. N87-14442
GOLES, E. N87-14908
GOLOVANOV, Y. N. N87-14484
GOMEZ, G. N87-14363
GONSALVEZ, D. J. A. N87-14872
GOODING, R. H. N87-14951
GOODMAN, A. A. N87-15127
GOSSARD, E. E. N87-14805
GOVIN, B. N87-14364
GRAADALEN, G. L. N87-15059

GRABITZ, G. N87-14294
GRAHAM, L. J. N87-14676
GRANGER, R. N87-14631
N87-14632
N87-14633
N87-14634
GRANT, J. T. N87-14469
GRANT, T. N87-15006
GRASDALEN, G. N87-15046
GRATZ, R. F. N87-14432
N87-14433
GRAY, F. G. N87-14964
GRAY, K. J. N87-14984
GREEN, K. N. N87-14378
GREENBAUM, E. N87-14833
GREENBERG, J. M. N87-15114
GREENHILL, L. J. N87-15054
GREENHOUSE, M. A. N87-15093
GREGORY, D. L. N87-14742
GRIFFIN, M. J. N87-14859
N87-15045
N87-15060
GRIFFIN, R. N87-15026
GRIFFITHS, H. D. N87-14769
GRILLAKI, D. N87-14825
GROENEWEG, J. F. N87-14957
GROLL, P. N87-14888
GROSPIERRE, A. N87-14445
GROSSE, H. N87-14988
GROTHEER, H. H. N87-14333
GUESTEN, R. N87-15083
N87-15095
GUIBERT, J. P. N87-14406
GUIDOS, B. J. N87-14647
GUINOMET, Y. N87-14508
GUIRGUIS, L. A. N87-14461
GULINO, D. A. N87-14423
GUNDERSEN, M. N87-14692
GUSTAVSSON, A. I. N87-14323
N87-14746

H

HAAL, U. N87-14400
HACHEY, J. P. N87-14672
HACINLIYAN, A. N87-15132
HACKING, P. N87-15078
HACKWELL, J. A. N87-15059
HADRBOLETZ, A. N87-14746
HAERTER, H. N87-14590
HAGER, M. E. N87-14792
HALE, J. K. N87-14920
N87-14921
N87-14922
HALLUM, G. W. N87-14518
HAMMARLUND, S. N87-14418
HAMMARSTRAND, U. N87-14821
HAMOEN, A. N87-14557
HANAI, T. N87-14318
HANEY, L. N. N87-14858
HANSON, A. R. N87-15033
HARDY, D. A. N87-14795
HARDY, H. R., JR. N87-14792
HARDY, T. L. N87-14422
HARRIS, A. W. N87-15123
HARRIS, D. C. N87-14485
HARRIS, R. P. N87-14971
HARTEN, U. N87-14968
HARTQUIST, T. W. N87-15081
HARTUNG, M. N87-14870
HARVEY, K. L. N87-15150
HARVEY, P. M. N87-15048
N87-15074
HASHIMOTO, I. N87-14462
HASHIMOTO, K. N87-14257
HASSLER, J. M., JR. N87-14314
HATAKEYAMA, M. N87-14253
HAYASHI, S. S. N87-15060
HEDGEPETH, J. M. N87-14413
HEERENS, J. N87-14752
HEERING, J. N87-14894
HEID, G. N87-14673
HEINEMANN, K. N87-14466
HEISSLER, W. N87-14767
HELAS, D. N87-14419
HELD, K. N87-14371
HELFAND, D. J. N87-15062
HELMINCK, G. F. N87-14953
HENKEL, C. N87-15095
HENRY, K. N87-14653
HENSON, L. A. N87-14540
HERBELL, T. P. N87-14518
HERBST, E. N87-15118
HERGENROTHER, P. M. N87-14515
HERMES, G. N87-14507
HERRMANN, J. N87-14614
HERTSBERG, A. N87-14651
HERTZBERG, R. W. N87-14497
N87-14739
HERTZBERGER, L. O. N87-14907
HEYMAN, J. S. N87-14559
HEYVAERTS, J. N87-15065
HILAIRE, G. N87-14721
HILLGER, W. N87-14437
N87-14439
HILLIER, M. N87-14726
HILPERT, K. N87-14453
HILTON, J. N87-15045
HIMENO, R. N87-14259
N87-14272
HIRANO, S. N87-14276
N87-14280
HIRAOKA, K. N87-14274
HIROOKA, Y. N87-15003
HIROSE, N. N87-14273
HISKES, J. R. N87-14967
HO, W. N87-14964
HOCKLING, T. N87-14990
HODES, B. A. N87-14847
HOEFKEN, K. D. N87-14788
HOEG, P. N87-14996
HOELMAKERS, H. W. M. N87-14640
HOEKSEMA, J. T. N87-15151
HOERLE, J. N87-14564
HOESSLER, B. N87-14709
HOFFMAN, D. J. N87-14428
HOFFMAN, N. J. N87-14969
HOFFMANN, H. E. N87-14324
N87-14326
N87-14822
HOFFMANN, W. N87-14896
HOGAN, P. G. N87-14884
HOGAN, W. J. N87-14969
HOLLAN, E. N87-14818
HOLLAND, L. R. N87-14971
HOLLANDER, M. N87-14935
HOLLECK, G. L. N87-14672
HOLLENBACH, D. J. N87-15043
HOLM, D. K. N87-14747
HOLZT, H. P. N87-14713
HOOGENBOOM, B. N87-14952
HOPMANN, H. N87-14431
HORNUNG, H. N87-14396
HOROWITZ, E. N87-14878
HOSHALL, C. H. N87-14384
HOWE, J. E. N87-15051
HOYLE, F. N87-14842
N87-15027
N87-15037
N87-15041
N87-15137
HUANG, X. Y. N87-14471
HUANG, Y. N87-14501
N87-14741
HUANG, Y. L. N87-15080
HUCK, W. N87-14346
HUEBLER, G. N87-14785
HUGHES, C. D. N87-14561
HUGHES, J. D. N87-15044
HUGHES, R. G. N87-14814
HURWITZ, M. N87-14972
HUSS, R. N87-14708
HUTT, G. R. N87-14397
HWANG, V. D. N87-15011

I

IJLST, P. N87-14615
IKEGAWA, M. N87-14256
IMLAY, S. T. N87-14645
ION, J. C. N87-14727
IRENE, E. A. N87-14470
IRVINE, W. M. N87-15120
N87-15149
ISAMBERT, P. N87-14371
ISHIDA, R. N87-14458
ISHIDA, Y. N87-14263
ISHIGURO, M. N87-14271
ISHII, R. N87-14249
ISHIZUKA, T. N87-14252
ITOH, N. N87-14263
ITOH, T. N87-15011
IVERSON, C. E. N87-14986
IWAKI, M. N87-14462

J

JACKLIN, S. A. N87-14910
JACKSON, J. N87-15121
JACQUELIN, M. N87-14447
JACQUET, P. N87-14903
JAFFE, D. T. N87-15083
JAHN, A. N87-14818
JAMES, S. D. N87-14599
JANDRASITS, W. G. N87-14707
JANICKA, J. N87-14784
JAY, C. N87-14871
JELER, S. N87-14463
JELSKI, D. N87-14471
JENEKHE, S. A. N87-14520
JENNINGS, E. N87-14886
JENSEN, B. J. N87-14515
JIN, K. K. N87-14654
JINCHENG, Z. N87-14286
JOERGENSEN, P. B. N87-14610
JOG, C. J. N87-15091
JOHNEN, F. J. N87-14785
JOHNSON, D. B. N87-14812
JOHNSON, P. N87-15050
JOHNSON, T. C. N87-14554
JOHNSTON, R. G. N87-14700
JOLLY, G. S., III N87-14417
JONES, A. R. N87-14884
JONES, B. N87-14836
JONES, E. D. N87-15018
JONES, E. M. N87-15079
JONES, K. R. N87-14756
JONES, R. E. N87-14427
JORDAN, A. K. N87-14571
JOSEPH, C. L. N87-15110
JOSSERAND, R. N87-14709
JOY, M. N87-15048
JUBIN, M. N87-14709
JUILIER, S. G. C. N87-14852
JUNKERMANN, W. N87-14785
JYONOUCHI, T. N87-14277

K

KAASE, H. N87-14989
KADNICHANSKIY, S. A. N87-15139
KAEHLER, M. N87-14818
KAFATOS, M. N87-15067
KAIFU, N. N87-15060
KAISER, M. K. N87-14845
KALANDIYA, A. I. N87-14729
KALAYCI, J. N87-15132
KALLMAN, R. R. N87-14577
KALUZA, J. N87-14325
KAMO, K. N87-14272
KANATANI, K. I. N87-14883
KANDOLA, B. S. N87-14657
KANG, B. S. N87-14494
KANIUTH, K. N87-14761
KANTOR, J. E. N87-14848
KARDOMATEAS, G. A. N87-14736
N87-14738
KARPEN, J. T. N87-15152
KASAL, P. N87-14338
KASSEL, S. N87-14690
KASSIES, A. N87-14288
KATZER, E. N87-14665
KAUL, U. K. N87-14644
KAULE, W. N87-14728
KAWAI, N. N87-14273
KAWAMURA, T. N87-14264
KAZMIERCZAK, H. N87-14767
KEDEM, B. N87-14919
KEENE, J. N87-15047
KELLER, K. R. N87-14415
KELLER, V. W. N87-14355
KELLY, H. F., IV N87-14357
KEMMER, J. N87-14683
KERSTEN, M. L. N87-14892
KESSLER, C. N87-14785
KESSLER, D. J. N87-14386
KHEDIM, A. N87-14785
KIEFER, R. N87-14988
KIKUCHI, T. N87-14462
KIM, J. N87-14285
KIMBLE, E. J. N87-14792
KIMURA, H. N87-14846
KINNS, R. N87-14372
KINS, L. N87-14785
KIRCHOEFER, S. W. N87-14600
KIRSCHKE, L. N87-14751
KITOH, A. N87-14811
KITOH, K. N87-14265
KLEINBERG, L. L. N87-14596
KLEMENT, D. N87-14593
KLINT, P. N87-14894
KLOP, J. W. N87-14825
KNAPIK, J. N87-14836
KNAUSS, W. G. N87-14528

KNIGHT, L. V. N87-14983
N87-14984
KNOCHE, K. F. N87-14784
KOBAYASHI, A. S. N87-14494
KOBAYASHI, T. N87-14265
KOBEDA, E. N87-14470
KOBRICK, J. L. N87-14837
KOCH, R. E. N87-14555
KOCK, H. N87-14411
KODAMA, Y. N87-14270
KOEHNE, R. N87-14995
KOENIGL, A. N87-15126
N87-15129
KOHL, J. L. N87-14674
KOHLMEIER, H. H. N87-14667
KOIDE, G. N87-14866
KOKMEIJER, E. N87-14477
KONG, J. A. N87-14567
KOOP, G. N87-14689
KOORNWINDER, T. H. N87-14952
KOPPENOL, P. J. N87-14656
KOPPENWALLNER, G. N87-14403
KOROLEV, A. K. N87-14464
KOTELNIKOV, V. A. N87-15139
N87-15143
KOUDELKA, O. N87-14562
KOURTA, A. N87-14660
KOZENKO, A. V. N87-15142
KOZENY, E. D. N87-14851
KRAFT, G. R. N87-14475
KRALL, A. D. N87-14575
KRAMER, A. N87-14838
KRANAKIS, E. N87-14906
N87-14925
KREEB, H. N87-14411
KRELOWSKI, J. N87-15105
KRISHNAIAH, P. R. N87-14942
KROEMER, H. N87-15010
KROHN, E. O. N87-14289
KRUGER, C. H. N87-14999
KUEHN, A. N87-14290
KUEHN, F. M. N87-14844
KUENTZMANN, P. N87-14476
KUENY, J. L. N87-14401
KULKARNI, V. G. N87-14865
KUMAR, K. N87-14434
KUO, A. N87-14319
KUO, L. N87-14934
KUWAHARA, K. N87-14248
N87-14259
N87-14264
N87-14268
N87-14272
KUZNETSOV, G. A. N87-14464
KWAK, D. N87-14644
KWOK, M. A. N87-14688

L

LAANANEN, D. H. N87-14306
N87-14307
LABRUJERE, T. E. N87-14288
LACOMBLEZ, M. N87-14505
LACONTI, A. B. N87-14468
LADA, E. N87-15055
LADOUCEUR, H. D. N87-14571
LAI, H. N87-14831
LAKE, M. L. N87-15002
LANDAU, D. P. N87-14961
LANE, A. P. N87-15062
LANGDORF, K. A. N87-14416
LANGER, W. D. N87-15058
LANKFORD, J. N87-14493
LANNELONGUE, N. N87-14828
LATTER, W. B. N87-15078
LAUCHLE, G. C. N87-14655
LAURIG, W. N87-14844
LAVAL, G. N87-15001
LAWLESS, P. A. N87-14473
LAWLESS, W. N. N87-15007
LEBOFSKY, M. J. N87-15096
LEBOUAR, P. N87-14364
LEBRETON, A. N87-14949
LECURU, D. N87-14721
LEE, A. R. N87-14316
LEE, D. C. L. N87-14764
LEE, R. Q. N87-14569
N87-14597
LEFEBER, B. N87-14509
LEFEBVRE, M. N87-14710
LEGER, A. N87-15098
LEGGE, H. N87-14403
LEGROS, J. C. N87-14409
LEHOCZKY, S. L. N87-15004
LEIGHTON, T. N87-14602
N87-14875
LEISERSON, C. N87-14602
LEISTE, H. N87-14542
LEITHERER, C. N87-15069
LEKOUDIS, S. G. N87-14648
LENGRAND, J. C. N87-14404
LENT, H. M. N87-14960
LEONARD, T. M. N87-14774
LEONE, S. R. N87-14796
LESTER, D. F. N87-15048
N87-15074
LEUNG, C. M. N87-15049
N87-15118
LEUNG, M. S. N87-14603
LEUNG, P. T. N87-14962
LEUNG, W. K. N87-15003
LEVCHENKO, A. K. N87-14464
LEVERANT, G. R. N87-14493
LEVIS, C. A. N87-14872
LEVY, M. N87-14319
LEWIN, W. H. G. N87-15156
LEWIS, C. H. N87-14859
LEWIS, E. A. N87-14470
LHOMME, A. N87-14548
LI, M. N87-14890
LIANG, R. H. N87-14392
LIAO, K. Q. N87-14586
LIBOFF, A. N87-14830
LIKKEL, L. N87-15051
LILWALL, R. C. N87-14790
LIMBOURG-FONTAINE, M. C. N87-14409
LIN, J. D. N87-14809
LIN, X. B. N87-14921
LINDER, C. N87-14349
LINDSAY, K. V. N87-14601
LINMARKER, L. N87-14588
LINO, C. D. N87-14360
LINTON, R. N87-14388
LIONEN, W. M. N87-14896
LITT, M. H. N87-14434
LITTLE-MARENIN, I. R. N87-15111
LITVAK, M. N87-14689
LLIBRE, J. N87-14363
LO, R. E. N87-14367
LOCK, M. W. B. N87-14244
LODDER, A. N87-14897
LOFFER, K. N87-14581
LONG, S. I. N87-15010
LONGDON, N. N87-14560
LONGPRE, L. N87-14890
LOPEZ, M. A. N87-14320
LOWELL, C. E. N87-14482
LUCAS, P. J. F. N87-14891
LUCIANI, J. F. N87-15073
LUEBECK, E. N87-14682
LUNDGREN, C. E. N87-14840
LUSSIER, A. R. N87-14837
LUTZ, B. N87-15130
LUTZ, G. N87-14683
LUX-STEINER, M. C. N87-14776

M

MACAIGNE, J. N87-14429
MACDONALD, S. L. N87-14310
MACH, H. N87-14479
N87-14480
MACKAY, H. J. N87-14783
MACLOW, M. M. N87-15067
MADDEN, S. C. N87-15120
MAGDALENO, R. E. N87-14351
MALACHOWSKI, K. N87-14824
MALONEY, P. N87-15068
MANDEL, J. N87-15006
MANDELKERN, L. N87-14530
MANDLER, M. B. N87-14695
MANSKI, D. N87-14430
MARCHBANKS, R. J. N87-14843
MARESH, C. M. N87-14835
MAREZ, M. N87-14505
MARINI, L. G. N87-14329
MARKLUND, G. N87-14791
MARKOV, M. S. N87-15141
MAROV, M. Y. N87-15148
MARSHALL, B. R. N87-14986
MARTIN, A. M. N87-14843
MARTIN, B. N87-15055
MARTIN, D. G. N87-14832
MARTINEZ, R. N87-14363
MARTY, A. N87-14914
MARUYAMA, Y. N87-14261
MASHESSE, J. M. N87-15123
MASSON, C. N87-15047
MASSON, C. R. N87-15056
MASTERS, G. N87-14573
MASTERS, P. A. N87-14426
MATHIEU, R. D. N87-15061
MATSUO, N. N87-14280
MATSUSHIMA, K. N87-14267
MATTHAEUS, G. N87-14611
MATTHEWS, H. E. N87-15120
MATTHEWS, L. W. N87-14424
MATTICK, A. T. N87-14651
MATZ, C. N87-14534
MAUDGAL, S. N87-14516
MAURER, R. H. N87-14377
MAXWORTHY, T. N87-14635
MAYR, B. N87-14590
MAZURKIEWICZ, M. N87-14452
MCCARGO, M. N87-14390
MCCAULEY, J. W. N87-14521
MCCLINTOCK, F. A. N87-14736
N87-14737
N87-14738
MCCRAY, R. N87-15067
N87-15115
MCGUINNESS, J. N87-14854
MCINTYRE, N. F. N87-14769
MCKAY, D. S. N87-14385
N87-14386
MCKEEN, R. G. N87-14356
MCLEAN, M. N87-14727
MCLEOD, R. W. N87-14859
MCMICHAEL, , IAN N87-14974
MCMILLEN, R. T. N87-14789
MCNALLY, J. J. N87-14977
MECHOSO, C. R. N87-14811
MEIER, G. E. A. N87-14294
MEIER, G. H. N87-14523
MEIER, U. N87-14333
MEIER, W. R. N87-14969
MEISENHOLDER, S. N87-14689
MEIXNER, F. N87-14785
N87-14788
MELKEMI, L. N87-14909
MELTZER, R. S. N87-14961
MERCHANT, V. E. N87-15002
MEREDITH, C. N87-14836
MERENYI, R. C. N87-14766
MERKLE, D. H. N87-14879
MERZENICH, K. N87-14587
MESNARD, J. N87-14317
METZDORF, J. N87-14989
MEYER, P. L. N87-14787
MICHEL, J. M. N87-14287
MIGRA, R. P. N87-14771
MIHELCIC, D. N87-14785
MILES, J. H. N87-14283
MILLER, D. R. N87-14809
MILROY, R. N87-14303
MINNET, P. N87-14765
MINNETT, P. J. N87-14574
MITCHNER, M. N87-14999
MITTELMANN, H. N87-14924
MITTER, S. K. N87-14941
MIYAKAWA, J. N87-14273
MIYOSHI, H. N87-14252
MOFFAT, R. J. N87-14620
MOLETTE, P. N87-14419
MOLTER, T. M. N87-14468
MONKEL, A. N87-14868
MONKMAN, D. J. N87-14780
MONTEIRO, S. N87-15060
MONTEIRO, T. S. N87-15045
MOOLHUIJSEN, E. J. N87-14715
N87-14716
MOORE, M. L. N87-15032
MOOY, W. G. P. N87-14907
MORA, P. N87-15073
MORAN, D. D. N87-14646
MORAN, J. M. N87-15052
N87-15054
MOREAU, P. N87-14478
MOREIRA, J. R. N87-14591
MORGAN, J. A. N87-15057
MORIARTY-SCHIEVEN, G. N87-15046
MORINISHI, K. N87-14258
MORIZUMI, N. N87-14846
MORSE, D. H. N87-15003
MOSELEY, H. N87-15113
MOSELEY, M. J. N87-14859
MOULIN, P. N87-14722
MOUNT-CAMPBELL, C. A. N87-14872
MOZURKEWICH, D. N87-15089
MRUGALA, M. N87-14792
MUEHLBAUER, P. N87-14327
MUELLER, K. P. N87-14788
MULLEN, S. N87-14837
MULLINS, B. R., JR. N87-14353
MUNDY, L. G. N87-15051
N87-15056
MUNIER, C. N87-14709

MUNZ, P. N87-14776
MURDOCH, J. N87-14419
MURPHY, E. B. N87-14414
MURRAY, K. A. N87-14969
MURROW, R. C. N87-14362
MUSIELA, M. N87-14949
MYERS, P. C. N87-15061
MYERS, S. N87-15051
MYERS, T. T. N87-14351

N

NACINI, E. N87-14785
NAFARI, N. N87-14500
NAGATA, T. N87-15100
NAGATI, M. G. N87-14278
NAGLE, K. N87-14856
NAIK, D. N. N87-14933
NAKADA, Y. N87-15100
NAKAHASHI, K. N87-14269
NAKAMICHI, J. N87-14279
NAKAMURA, A. N87-14261
NAKAMURA, T. N87-14255
NAKAMURA, Y. N87-14271
NAKANO, S. N87-14256
NALLASAMY, M. N87-14957
NATHANSON, D. M. N87-14414
NAUMANN, R. J. N87-15004
NAUSS, M. M. N87-14839
NEARY, J. M. N87-14790
NELSON, M. A. N87-14986
NEMECK, F. N87-14711
NETTER, G. N87-14410
NEU, R. N87-14767
NEUHOFF, D. L. N87-14882
NEWMAN, P. N87-14382
NICHOLS, J. M. N87-14854
NICKEL, H. N87-14452
NICOLA, V. F. N87-14865
NIELSEN, C. J. N87-14996
NIESTADT, R. M. N87-14970
NILSSON, F. N87-14418
NISENSON, P. N87-15036
NISHIDA, H. N87-14258
NITSCHKE-KOWSKY, P. N87-14664
NIX, W. D. N87-14498
NOHISA, T. N87-14277
NOMOTO, H. N87-14274
NOMOTO, K. N87-15135
NOONAN, K. W. N87-14282
NORDHAUSEN, B. N87-14911
NOVOTNY, E. N87-14769
NOYES, R. W. N87-15036
NURMIKKO, A. V. N87-15013
NYBERG, S. N87-14588

O

OBAYASHI, S. N87-14266
N87-14267
OBRIEN, C. J. N87-14424
OCHOA, O. O. N87-14321
ODA, K. L. N87-14392
ODELL, A. W. N87-14951
ODELL, C. R. N87-15070
ODETTE, G. R. N87-14503
OECHSLEIN, W. N87-14398
OEGELMAN, H. N87-15155
OGLE, J. W. N87-14986
OHAVER, T. N87-14524
OHAYON, R. N87-14743
OHLS, K. D. N87-14451
OHR, S. M. N87-14740
OLEARY, D. P. N87-14923
OLSON, M. P. N87-14823
OLSON, R. E. N87-14969
ONAKA, T. N87-15100
ONEILL, K. M. N87-14599
ORTEGA, A. N87-14620
OSBOURN, G. C. N87-15018
OSTRIKER, J. P. N87-15091
OSTROVSKIY, M. V. N87-15139
N87-15143
OTIS, G. N87-14693
OUERDANI, A. N87-14618
OWEN, R. B. N87-14355
OYEVAAR, T. N87-14970

P

PACHECO, M. N87-15015
PADGETT, W. J. N87-14944
PAEZ, T. L. N87-14742
PAGE, R. J. N87-14425
PALKA, D. N87-14823
PALMER, J. D. N87-14565
PAPALIOLIOS, C. N87-15036
PARADAN, T. N87-14878
PARK, C. G. N87-14740
PARK, J. J. N87-14383
PARKER, G. W. N87-14832
PARKER, J. H., JR. N87-15007
PARKER, T. E. N87-14975
PARKIN, B. R. N87-14650
PATTERSON, J. N87-14886
PATTERSON, M. J. N87-14422
PATTERSON, R. D. N87-14303
PATTON, B. R. N87-15007
PAUVERT, C. N87-14359
PAVLOVICH, R. D. N87-14356
PAXMAN, R. G. N87-14882
PEDEN, C. H. F. N87-14529
PEDERSEN, F. H. N87-14610
PEDERSEN, J. C. N87-14578
PEDERSEN, N. E. N87-14578
PEEKEN, H. N87-14507
PELISCHEK, T. E. N87-14373
PELLOUX, R. M. N87-14492
PEMPIE, P. N87-14399
PENA, M. N87-15072
PENDLETON, Y. N87-15108
PEPLINSKI, D. R. N87-14449
PERAULT, M. N87-15065
N87-15125
PERBOS, J. N87-14828
PERKINS, R. T. N87-14984
N87-14985
PERNISZ, U. N87-15016
PERRY, C. H. N87-14532
PESME, D. N87-15001
PETER, R. N87-14818
PETERSEN, J. D. N87-14538
PETERSON, B. G. N87-14984
PETRE, G. N87-14409
PETRE, R. N87-15104
PETROV, G. I. N87-15143
PETROV, G. M. N87-15139
PETTIT, F. S. N87-14523
PEW, H. K. N87-14985
PEYRE, J. P. N87-14504
PFEIFFER, H. N87-14777
PHILBRICK, S. N87-14553
PHILLIPS, T. E. N87-14384
PIACSEK, S. N87-14825
PISTONE, R. A. N87-14850
PLOHR, B. J. N87-14966
PLSKO, E. N87-14456
POGGIO, M. N87-14887
POLAND, A. I. N87-15150
PONTIER, P. N87-14709
PONZONI, F. J. N87-14764
POST, D. N87-14494
POSTA, S. J. N87-14730
POSTLETHWAITE, I. N87-14912
POTET, M. L. N87-14903
POTTER, A. E. N87-14366
POWELL, M. S. N87-14414
POWELL, R. J. N87-14769
PREVOST, M. N87-14476
PRICE, H. G. N87-14426
PRICE, S. D. N87-15111
PRICE, W. L. N87-15022
PRIMDAHL, F. N87-14791
N87-14996
PROFFITT, D. R. N87-14845
PRONIN, A. A. N87-15139
N87-15143
N87-15144
PROSCHAN, F. N87-14937
PROUDFOOT, G. G. N87-14757
PUGA, L. C. N87-15042
PUGET, J. L. N87-15065
N87-15125
PURI, S. N87-14582

Q

QUON, S. N87-14689

R

RACH, E. N87-14995
RADESPIEL, R. N87-14292
RADKE, R. E. N87-14861
RAFFIN, M. N87-14404
RAHMAN, S. M. M. N87-14499
RAINEY, R. N87-15045
N87-15060
RAJ, R. N87-14495
RAMAKRISHNAN, S. N87-14612
RAMIREZ, J. C. N87-14732
RANK, D. M. N87-15075
N87-15101
RAO, M. A. N87-15010
RASMY, A. H. N87-14461
RAUDENBUSH, E. R. N87-14960
RAUGEL, G. N87-14921
RAWLIN, V. K. N87-14422
RAWLINS, W. T. N87-14975
REED, J. W. N87-14786
REEFMAN, R. N87-14901
REGAN, D. N87-14849
REICH, F. N87-14995
REICHERT, R. N87-14860
REILLY, C. H. N87-14872
REIN, M. N87-14294
REINWARDT, D. N87-14485
REISLER, H. N87-14692
REISS, P. N87-14763
RELANDEAU, C. N87-14445
RENNER, M. N87-14506
RHOADS, C. J. N87-14854
RHOADS, G. D. N87-14393
RHODES, M. D. N87-14413
RHODES, W. H. N87-14979
RICCITIELLO, S. R. N87-14442
RICH, F. J. N87-14795
RICHARD, H. G. N87-14784
RICHARD, M. N87-14693
RICHARDS, K. J. N87-14829
RICHARDS, R. E. N87-14858
RICHARDS, W. B. N87-14284
RICHARDSON, K. J. N87-15045
RICHMOND, C. N87-14780
RICHMOND, G. C. N87-14782
RIEKE, G. H. N87-15096
RIGAL, M. N87-14505
RINNER, K. N87-14759
RIORDAN, P. N87-14810
RIPPEN, M. E. N87-14524
RISEMAN, E. M. N87-15033
RITTER, J. W. N87-14378
RIVES, J. E. N87-14961
ROBERT, Y. N87-14904
ROBINSON, G. A. N87-14385
ROBINSON, J. C. N87-14390
ROCHA, C. N87-14922
RODENBURG, L. J. N87-14448
RODIONOVA, Z. F. N87-15140
RODRIQUEZ, L. F. N87-15062
ROEFS, H. F. A. N87-14868
ROESKE, F. N87-14582
ROGERS, S. E. N87-14644
ROHART, F. N87-14504
ROLFE, E. N87-14770
ROMAN, J. H. N87-14850
ROMANOSKI, G. R. N87-14492
RONKA, L. B. N87-15146
ROOZEN, H. N87-14946
ROSEN, D. I. N87-14975
ROSENBLATT-ROTH, M. N87-14943
ROSENFELD, A. N87-14311
ROSENKRANZ, P. W. N87-14568
ROSTECK, H. N87-14702
ROTH, J. R. N87-15000
ROTH, R. N87-14324
ROTHENBERG, R. N87-14901
ROTTMANN, J. N87-14450
ROUEFF, E. N87-15081
RUBIN, I. N87-14579
RUBIO, M. N87-15072
RUIZ, M. T. N87-15072
RUPICH, M. W. N87-14672
RUPPERSBERG, G. H. N87-14992
RYZNAR, E. N87-14808
RZHIGA, O. N. N87-15139
N87-15140
N87-15143

S

SAGE, J. P. N87-14976
SAINT-AUBERT, P. N87-14419
SAINTCHELY, J. N87-14710
SAKAMOTO, K. N87-14251
SAKATA, A. N87-15100
SAKHO, I. N87-14908
SALLENAVE, A. D. C. N87-14852
SALZMAN, G. C. N87-14700
SAMUELSSON, L. A. N87-14418
SANDAHL, I. N87-14791
SANDERS, D. B. N87-15090
SANDERS, J. L., JR. N87-14734

SANDFORD, S. A. N87-15099
SANSONI, B. N87-14454
SANTOS-MASON, B. N87-14389
SARKER, D. K. N87-14499
SATKIEWICZ, F. G. N87-14384
SATOFUKA, N. N87-14258
SAUTHOFF, G. N87-14481
SAVAGE, C. N87-14402
N87-14411
SAWADA, K. N87-14277
SAYER, S. N87-14677
SAYERS, C. M. N87-14754
N87-14757
SCHACHER, G. E. N87-14807
SCHAEFER, J. R. N87-14813
SCHAFFT, H. N87-15006
SCHERRER, P. H. N87-15151
SCHICKEL, K. P. N87-14325
SCHILD, R. E. N87-15061
N87-15102
SCHIPPERS, F. H. N87-14892
SCHIRBER, J. E. N87-15018
SCHLOERB, F. P. N87-15057
N87-15149
SCHLOERB, P. N87-15046
SCHMELZ, J. T. N87-15094
SCHMIDT, E. N87-14342
SCHMIDT, G. N87-14431
SCHMIDT, K. H. N87-14844
SCHMIDT, W. N87-14431
SCHMITT, W. N87-14753
N87-14948
SCHMITZ, H. D. N87-14611
SCHNEIDER, F. N87-14784
SCHNOENHOLZ, R. N87-14543
SCHNURR, A. D. N87-14689
SCHOETTLE, U. M. N87-14345
SCHRA, L. N87-14744
SCHRAMM, L. S. N87-14385
N87-14386
SCHREY, U. N87-15040
SCHRODER, J. E. N87-14996
SCHROEDER, J. A. N87-14806
SCHROT, J. N87-14830
SCHROTH, R. N87-14762
SCHUETZE, R. N87-14437
N87-14438
N87-14441
SCHULTZ, J. L. N87-14401
SCHULTZ, R. A. N87-14386
SCHULZE, O. N87-14481
SCHUTTE, W. A. N87-15114
SCHWALBE, K. H. N87-14752
SCHWARZ, G. N87-14332
SCIVETTI, A. N87-15060
SCOTT, E. H. N87-15128
SCOVILLE, N. Z. N87-15090
SCRUBY, C. B. N87-14756
SEACORD, A. W., II N87-14915
SEEFELD, D. N87-14778
SEGALL, S. B. N87-14696
SEGURA, N. N87-14504
SEILER, F. N87-14661
SELF, S. A. N87-14999
SELLGREN, K. N87-15100
N87-15103
N87-15106
SEPPELT, B. N87-14555
SERAFINI, J. S. N87-14428
SETHURAMAN, J. N87-14937
SHAFEE, A. N87-14816
SHAFEE, S. N87-14816
SHAFFER, J. T. N87-14443
SHAFI, Q. N87-15133
SHAKED, M. N87-14718
N87-14939
SHALTENS, R. K. N87-15031
SHANTHIKUMAR, J. G. N87-14718
N87-14939
SHARP, D. H. N87-14966
SHARP, K. N87-15016
SHEA, D. N87-14350
SHEN, S. F. N87-14649
SHENTON, S. P. N87-14246
SHIDA, Y. N87-14268
SHIH, C. H. N87-14741
SHIKANO, Y. N87-14256
SHINN, J. L. N87-14916
SHINOKAWA, N. N87-14276
SHIPMAN, J. D. N87-14694
SHIRAYAMA, S. N87-14264
N87-14272
SHOR, P. N87-14875
SHOTT, J. N87-15006
SHUEN, J. S. N87-14348
SHULER, R. L., JR. N87-14863
SHULL, J. M. N87-15084
N87-15124
SIDORENKO, A. I. N87-15139
N87-15143
SIEGMAN, A. E. N87-14697
SIERADZKI, K. N87-14502
SIGL, R. N87-14759
SIGRIST, M. W. N87-14787
SILK, M. G. N87-14726
SILVA, M. D. N87-15005
SILVERBERG, R. F. N87-15113
SIMKOVICH, G. N87-14496
SIMO, C. N87-14363
SINGHAM, S. B. N87-14700
SJOBERG, W. F. N87-14768
SKINNER, D. N87-14378
SLACHMUYLDERS, E. N87-14402
SMETANA, J. N87-14569
SMIGIELSKI, P. N87-14680
SMITH, A. N87-15156
SMITH, J. H. B. N87-14636
SMITH, M. N87-14442
SMITH, P. H. N87-14599
SMITH, R. E. N87-14971
SMITH, R. G. N87-15100
N87-15106
SMITH, R. L. N87-14755
SMITH, W. D. N87-14330
SNELL, R. N87-15046
SNELL, R. L. N87-15057
N87-15080
N87-15119
SNOW, T. P. N87-15122
SNOW, T. P., JR. N87-15112
SOMMEIJER, B. P. N87-14927
N87-14928
SONDERGELD, K. P. N87-14717
SOO, D. N. N87-14402
SPAGNA, G. F., JR. N87-15049
SPAHR, J. A. N87-14811
SPAIN, IAN N87-15012
SPALDING, D. B. N87-14658
N87-14659
SPECK, J. S. N87-14486
SPECK, M. E. N87-14570
SPEKREIJSE, S. P. N87-14955
SPIEGEL, K. H. N87-14958
SPLETTSTOESSER, W. R. N87-14958
SQUIRE, V. A. N87-14769
STACHNIK, R. V. N87-15036
STAELIN, D. H. N87-14568
STAHL, B. N87-14959
STANDLEY, D. N87-14874
STANISLAS, M. N87-14673
STAPLEY, B. N87-14589
STARK, A. A. N87-15058
N87-15062
N87-15082
STARKE, E. A., JR. N87-14491
STAUDACHER, B. N87-14988
STAVRAKAKIS, N. N87-14920
STCLAIR, T. L. N87-14516
STEINOLFSON, R. S. N87-15153
STENCEL, R. E. N87-15116
STEPHENS, M. A. N87-14945
STERN, K. H. N87-14519
STEVENS, D. J. N87-14539
STEWART, G. W. N87-14923
STIEB, A. N87-14988
STIES, M. N87-14767
STODDARD, M. L. N87-14850
STOECKL, H. N87-14753
STOLLER, R. E. N87-14503
STONER, W. A. N87-14425
STOOP, B. T. J. N87-14714
STRAHLE, W. C. N87-14648
STRAKA, J. N87-14365
STRICKER, W. N87-14336
STROM, K. N87-15046
STROM, S. N87-15046
STRUTT, J. E. N87-14244
STUCKEY, W. K. N87-14391
STUPIAN, G. W. N87-14603
STUREK, W. B. N87-14647
STUTZKI, J. N87-15083
SUAREZ, M. J. N87-14811
SUBRAMANIAN, C. S. N87-14657
SUGG, F. E. N87-14676
SUKHANOV, A. L. N87-15143
N87-15147
SUNDQVIST, H. N87-14821
SUNDSTROEM, D. N87-14588
SUSZKO, S. F. N87-14594
SYLWAN, O. N87-14418
SZODRUCH, J. N87-14328
SZTJNO, M. N87-15156
SZYMKOWIAK, A. N87-15104

T

TAASAN, S. N87-14862
TAFF, L. G. N87-14677
TAK, C. C. N87-14748
TAKAHASHI, D. N87-14248
TAKAISHI, K. N87-14462
TAKANASHI, S. N87-14275
TAKSAR, M. I. N87-14938
TANG, F. Y. C. N87-15150
TANIGUCHI, M. N87-14942
TARAFDAR, S. P. N87-15064
TCHUENTE, M. N87-14908
TEICHERT, B. D. N87-14701
TEREBEY, S. N87-15121
THEILHABER, K. N87-15001
THEOFANUS, T. G. N87-14549
N87-14550
THOMAS, J. R. N87-14830
THORNE, J. M. N87-14983
N87-14984
N87-14985
THORPE, J. N87-14296
N87-14299
N87-14302
THRONSON, H. A., JR. N87-15043
N87-15050
N87-15078
N87-15089
N87-15093
TICK, P. A. N87-14526
TIELENS, A. G. G. M. N87-15101
N87-15108
TIELENS, G. G. M. N87-15075
TIMM, H. N87-14778
TITTMANN, B. R. N87-14572
TODA, N. N87-14274
TODD, R. H. N87-14731
TOKSOZ, M. N. N87-14794
TOKUNAGA, A. T. N87-15100
N87-15106
TORRES-PEIMBERT, S. N87-15097
TOURNIER, C. N87-14504
TOWNEND, C. K. N87-14308
TOWNEND, L. H. N87-14412
TRACEY, K. L. N87-14826
TRACY, F. J. N87-14598
TRICKETT, E. A. N87-14979
TRIESCH, K. N87-14289
TRINKS, H. N87-14405
TRIVEDI, K. S. N87-14865
TROOST, J. N87-14681
TRUEMPER, J. N87-15156
TSANG, E. K. N87-14565
TSOI, S. H. N87-14944
TUBBING, B. J. D. N87-14970
TUCKDER, J. V. N87-14895
TURNBULL, R. J. N87-14965
TUSCH, J. N87-14371
TUSCHE, S. N87-14291
TWEED, H. M., JR. N87-14598
TWEED, J. J. N87-14843
TWIST, J. R. N87-15002
TYLER, J. N. N87-14566
TYUFLIN, Y. S. N87-15139
N87-15140
N87-15143

U

UBER, J. M. N87-14379
UCHIDA, K. N87-14251
UCHIDA, T. N87-14277
UHT, J. N87-14391
ULANDER, L. M. H. N87-14769
UWIRA, K. N87-14325
UY, O. M. N87-14377
N87-14384

V

VACCA, W. D. N87-15156
VAILLANT, D. N87-14828
VALENT, R. N87-14901
VALENTIAN, D. N87-14429
VANAJAKSHI, C. T. N87-15128
VANALSTINE, R. L. N87-14378
VANDENAKKER, H. E. A. N87-14545
VANDENHEUVEL, W. M. C. N87-14612
VANDERGAAG, L. C. N87-14893
VANDERHOFF, J. A. N87-14537
VANDERHORST, C. H. T. N87-14613

VANDERHOUWEN, P. J. N87-14928
VANDERMEER, J. C. N87-14954
VANDISHOECK, E. F. N87-15117
VANEIJNDHOVEN, J. T. J. N87-14897
VANGULICK, P. N87-14285
VANMEER, A. C. P. N87-14900
VANPARADIJS, J. N87-15156
VANSCHALKWIJK, R. N87-14901
VANSTEENBERG, M. E. N87-15124
VANSTIPHOUT, M. T. N87-14897
VANWANING, W. E. N87-14907
VAYONAKIS, C. E. N87-15134
VENTRON, B. N87-14709
VERON, M. C. N87-14852
VERSCHUUR, G. L. N87-15086
VEST, C. E. N87-14384
VINCENT, D. N87-14693
VITANYI, P. M. B. N87-14890
N87-14906
VITTITOE, C. N. N87-14583
VLASSE, M. N87-15004
VOGEL, J. M. N87-14278
VOGEL, S. N87-15121
VOIT, G. M. N87-15084
VOLDNER, E. C. N87-14823
VONLAVEN, S. N87-14696
VONPRAGENAU, G. L. N87-14420
VONSCHNERING, H. G. N87-14457
VORROPOULOS, G. N87-14641
VOULELIKAS, G. D. N87-14421
VREEBURG, J. P. B. N87-14408

W

WACHE, G. N87-14722
WADA, S. N87-15100
WAEGEL, K. H. N87-14616
WAGNER, G. N87-14802
WAGNER, J. N87-14854
WAHLBORN, S. N87-14947
WALKER, C. E. N87-15096
WALKER, G. A. H. N87-15105
WALKER, J. G. N87-14782
WANG, K. L. N87-15009
WANHILL, R. J. H. N87-14744
WANNAMAKER, B. N87-14765
WARD, F. R. C. N87-14304
WARD, J. F. N87-14696
WARREN, J. L. N87-14386
WARWICK, K. N87-14913
N87-14930
WASCHER, L. N87-14857
WATANABE, T. N87-14250
WATERMAN, P. C. N87-14578
WATKINS, J. N87-14842
WATTS, D. R. N87-14826
WATTS, L. A. N87-14386
WEI, G. C. N87-14979
WEILAND, C. N87-14395
WEINACHT, P. N87-14647
WEISS, B. N87-14746
WEISSER, M. N87-14616
WELCH, W. J. N87-15121
WELSCH, G. E. N87-14483
WENDT, J. F. N87-14641
N87-14642
WENSIERSAKI, P. W. N87-14775
WENTWORTH, S. J. N87-14386
WERLE, H. N87-14662
WERNER, M. N87-15108
WERNER, M. W. N87-15103
WETZIG, V. N87-14682
WEXLER, B. L. N87-14694
WHANG, Y. C. N87-15131
WHITAKER, A. N87-14388
WHITCOMB, B. M. N87-14982
WHITE, G. J. N87-15045
N87-15060
WHITE, R. E. N87-15071
WHITE, W. T. N87-14355
WICKRAMASINGHE, N. C. N87-14842
N87-15027
N87-15037
N87-15137
WILCOX, R. B. N87-14608
WILKING, B. A. N87-15051
WILKINS, R. L. N87-14688
WILLIAMS, B. N87-14857
WILLIS, J. P. N87-14460
WILSON, J. N87-14246
WILSON, K. L. N87-15003
WILSON, M. H. N87-14599
WILSON, M. L. N87-14731
WILSON, R. W. N87-15058
N87-15082
WIMBERGER, H. J. N87-14708
WINDSCHEID, F. N87-14968
WINSBURY, R. N87-14589
WINSLOW, T. S. N87-14695
WISE, H. F. N87-14672
WITT, A. F. N87-15008
WITT, A. N. N87-15102
WITT, C. N87-14837
WITTE, K. L. N87-14793
WITTEBORN, F. C. N87-15075
N87-15101
WITTEN, M. A. N87-14576
WITTIE, L. D. N87-14905
WITTIG, C. N87-14692
WOIZENKO, E. N87-14834
WOLBERT, R. R. N87-14707
WOLF, D. M. N87-14367
WOLF, E. N87-14760
WOLFIRE, M. G. N87-15063
WOOD, L. L. N87-15029
WOOD, R. M. N87-14675
WOODBURY, R. C. N87-14983
WOODEN, D. N87-15101
WOODEN, D. H. N87-15075
WORSWICK, R. N87-14359
WRENCH, C. L. N87-14769
WRIGHT, G. B. N87-15032
WRIGHT, M. C. H. N87-15083
WU, Y. N87-14936
WUENSCH, B. J. N87-14531
WUEST, M. R. N87-14320
WYATT, J. L., JR. N87-14874
WYCKOFF, S. N87-15130

X

XIANGRUI, L. N87-14286
XU, Y. N87-15115
XUESHI, T. N87-14286
XUEYING, D. N87-14286

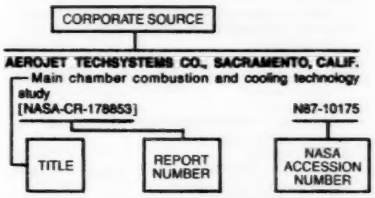
Y

YAGI, E. N87-14462
YAHEL, R. Z. N87-15154
YAKUTIS, A. J. N87-14677
YAMAGUCHI, H. N87-14462
YAMAMOTO, Y. N87-14260
N87-14262
YAMAZAKI, K. N87-14811
YANG, C. L. N87-14490
YANTA, W. J. N87-14643
YASGUR, D. N87-14319
YASUHARA, M. N87-14271
YEE, H. C. N87-14916
YEH, P. N87-14974
YING, Z. N87-14964
YOSHIDA, M. N87-14266
YOUNG, R. W. N87-14419
YU, K. F. N87-14940

Z

ZAGAJA, J. A. N87-14468
ZAKHAROV, A. I. N87-15143
ZANA, L. M. N87-14428
ZANELLI, C. N87-14553
ZAPLATYNSKY, I. N87-14487
N87-14488
ZARTMANN, I. N87-14465
ZELLNER, J. W. N87-14703
ZERNECKE, R. N87-14761
ZHANG, F. N87-14668
ZHARKOV, V. M. N87-15142
ZICK, R. N87-14751
ZIMMER, K. N87-14455
ZIMMERMAN, N. B. N87-14442
ZIPPERIAN, T. E. N87-15017
ZIURYS, L. M. N87-15119
ZOOK, H. A. N87-14385
N87-14386
N87-14387
ZYDA, M. J. N87-14880
N87-14884

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACADEMIA SINICA, SHENYANG (CHINA).
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741

ADVANCED PROPULSION AND ENERGY CONTROL SYSTEMS LTD., HAUTS (ENGLAND).
Base pressure control for aerospace vehicles
N87-14412

AEG-TELEFUNKEN, WEDEL (WEST GERMANY).
Processing of gray-value image sequences
[BMFT-FB-DV-86-006] N87-14990

AEROJET TECHSYSTEMS CO., SACRAMENTO, CALIF.
Dual-throat thruster thermal model
[NASA-CR-178975] N87-14424

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Measurements of landing gear loads of a commuter airliner
[FFA-TN-1986-37] N87-14323
Ultrasonic fatigue studies of short and long surface cracks
[FFA-TN-1986-44] N87-14746
Load interaction effects on fatigue crack propagation in steels of varying strength
[FFA-TN-1986-47] N87-14747

AERONAUTICAL RESEARCH LABS., MELBOURNE (AUSTRALIA).
A laboratory evaluation of liquid cooled vests for non-combatants
[AD-A170417] N87-14856

AEROSPACE CORP., EL SEGUNDO, CALIF.
Application of an atomic oxygen beam facility to the investigation of shuttle glow chemistry
[ATR-85(8367)-1] N87-14449
Special techniques for the Auger analysis of microelectronic devices
[AD-A171631] N87-14603
The status of rotational nonequilibrium in HF chemical lasers
[AD-A169436] N87-14688

AIR FORCE ACADEMY, COLO.
MMU (Manned Maneuvering Unit) task simulator
[AD-A169552] N87-14370

AIR FORCE ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER, SCOTT AFB, ILL.
A simulation feasibility study
[AD-A169651] N87-14793

AIR FORCE FLIGHT TEST CENTER, EDWARDS AFB, CALIF.
C-130/C-141 center vertical restraint
[AD-A170438] N87-14320

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
A simple model of auroral electrodynamics compared with HILAT measurements
[AD-A170320] N87-14795
The shapes of the circumstellar silicate features
N87-15111

AIR FORCE HUMAN RESOURCES LAB., BROOKS AFB, TEX.
Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies
[AD-A170353] N87-14848

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Implementation of the Numerical Electromagnetic Code (NEC-2) for modeling the VOR (Very-high-frequency Omni-directional Range) navigation system in the presence of parasitic scatterers
[AD-A170669] N87-14312
Development of mechanistic flexible pavement design concepts for the heavyweight F-15 aircraft
[AD-A170902] N87-14357
Statistical models for predicting the change in mean motion of a satellite over time including the effects of solar flux
[AD-A170591] N87-14361
Frozen orbits-near constant or beneficially varying orbital parameters
[AD-A170675] N87-14362
A method for governing spacecraft evasive maneuvering
[AD-A170896] N87-14415
A zero extraction and separation technique for surface acoustic wave and digital signal processing FIR (Finite Impulse Response) filter implementation
[AD-A170855] N87-14601
Model simulation of a localized high intensity heat source interacting with cooled metal plates
[AD-A170856] N87-14652
Modification of parameterized latent heat release estimates using unenhanced and enhanced satellite imagery
[AD-A170899] N87-14768
Observing the synoptic structure of two moisture bursts
[AD-A170670] N87-14813
Dynamic and thermodynamic characteristics of a microburst-producing storm in Colorado determined from JAWS (Joint Airport Weather Studies) dual-doppler data
[AD-A170673] N87-14814
Time series prediction of hurricane landfall
[AD-A170742] N87-14815
The effects of physical conditioning on heat tolerance in chemical defense gear
[AD-A170903] N87-14839
Enhanced simulation output through the use of spreadsheet software
[AD-A170671] N87-14881
Ion assisted deposition of optical coatings
[AD-A170672] N87-14977
Feasibility investigation into the use of a liquid crystal television as a spatial light modulator
[AD-A170898] N87-14980

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Acta Aeronautica et Astronautica Sinica (selected articles)
[AD-A170157] N87-14286
Acta Armamentarii (selected articles)
[AD-A170158] N87-14536

AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417

AIR FORCE WRIGHT AERONAUTICAL LABS., WRIGHT-PATTERSON AFB, OHIO.
The interfacial and compressive properties of polybenzothiazole fibers
[AD-A171620] N87-14527

ALPHATECH, INC., BURLINGTON, MASS.
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580

ANALYTIC SCIENCES CORP., READING, MASS.
Aided-airborne Gravity Gradiometer Survey System (GGSS) study
[AD-A170749] N87-14766

APPLIED RESEARCH ASSOCIATES, INC., ALBUQUERQUE, N. MEX.
Computational aspects of the ARA three invariant constitutive model
[AD-A170072] N87-14879

ARECIBO IONOSPHERIC OBSERVATORY, PUERTO RICO.
Is OH abundance enhanced in tidally distorted galaxies? N87-15094

ARIZONA STATE UNIV., TEMPE.
Comet P/Halley 1910, 1986: An objective-prism study
N87-15130

ARIZONA UNIV., TUCSON.
On the first failure time of dependent multicomponent reliability systems
[AD-A170223] N87-14718
Multi-grid continuation and spurious solutions for nonlinear boundary value problems
[AD-A173081] N87-14924
Stochastic convexity and its applications
[AD-A170112] N87-14939
Size-density relations in dark clouds: Non-LTE effects
N87-15068
Mass return to the interstellar medium from highly-evolved carbon stars N87-15078
Spiral arms and massive star formation: Analysis of the CO face-on pictures of the galaxy N87-15090
Molecular hydrogen in the young starburst in NGC 253
N87-15096

ARKANSAS UNIV., FAYETTEVILLE.
Time-resolved studies of molecular processes involving transient species by synchronously-pulsed optical excitation and diagnostic electron scattering
[AD-A169624] N87-14963

ARMY CLOSE COMBAT ARMAMENTS CENTER, WATERVLIET, N.Y.
Stress and deformation analysis of autofrettaged high pressure vessels
[AD-A170257] N87-14733

ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
Resilient modulus of freeze-thaw affected granular soils for pavement design and evaluation. Part 4: Field validation tests at Albany County Airport
[DOT/FAA/PM-84/16,4] N87-14554
An introduction to heat tracing
[AD-A170877] N87-14653

ARMY ENGINEER TOPOGRAPHIC LABS., FORT BELVOIR, VA.
World weather extremes: Revision
[AD-A170138] N87-14810

ARMY MATERIALS TECHNOLOGY LAB., WATERTOWN, MASS.
Self-propagating High-temperature Synthesis (SHS): Current status and future prospects
[AD-A169588] N87-14521

ARMY MEDICAL RESEARCH INST. OF INFECTIOUS DISEASES, FORT DETRICK, MD.
Technique for cardiovascular monitoring in awake tethered rats
[AD-A170246] N87-14832

ARMY RESEARCH INST. OF ENVIRONMENTAL MEDICINE, NATICK, MASS.
Influence of a 3.5 day fast on physical performance running heading: Fasting and performance
[AD-A169597] N87-14836
A computerized system for measuring detection sensitivity over the visual field
[AD-A169600] N87-14837

ATMOSPHERIC ENVIRONMENT SERVICE, DOWNSVIEW (ONTARIO).
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823

ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON (ENGLAND).
Redetermination of earthquake body-wave magnitudes (m sub b) using ISC bulletin data
[AWRE-O-21/85] N87-14790
AUSTRALIAN ATOMIC ENERGY COMMISSION, LUCAS HEIGHTS.
A method and a device to determine the crack depth of surface cracks
[BLL-TRANS-AAEC-798-(1797.43)] N87-14728

B

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Kinetic mechanisms for premixed, laminar, steady state hydrogen-nitrous oxide flames
[AD-A169404] N87-14467
Electrical conductance of liquid propellants: Theory and results
[AD-A170361] N87-14537
PNS (Paraboilzed Navier-Stokes) for spinning shell at moderate angles of attack and for long L/D finned projectiles
[AD-A169531] N87-14647
BASCOM-TURNER INSTRUMENTS, NORWOOD, MASS.
Fabrication and testing of a prototype handheld electrochemical CO monitor
[PB86-233848] N87-14672
BAYER A.G., DORMAGEN (WEST GERMANY).
Investigation of the influence of the impact friction coefficient on pneumatic conveying (Friction Pressure Loss (FPL) 304)
[BMFT-FB-W-86-009] N87-14711
BELL TELEPHONE LABS., INC., HOLMDEL, N. J.
Filamentary structure in the Orion molecular cloud N87-15058
CO near the Pleiades: Encounter of a star cluster with a small molecular cloud N87-15071
A CS J = 2 1 survey of the galactic center region N87-15082
BENTLEY COLL., BOSTON, MASS.
H and K maps of two star-forming regions: S 140 and CEP A OB3 N87-15059
BOEING COMMERCIAL AIRPLANE CO., SEATTLE, WASH.
Test and evaluation of a multifunction keyboard and a dedicated keyboard for control of a flight management computer
[NASA-CR-178202] N87-14330
BOGAZICI UNIV., ISTANBUL (TURKEY).
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132
BONN UNIV. (WEST GERMANY).
Models for the prediction of polar coordinates of lunar reflectors in the dynamic Earth-Moon system
[REPT-69] N87-14701
Delay estimation in digital correlation interferometers with special consideration of the MK 2 system of the Max-Planck Institute of Radio Astronomy
[REPT-68] N87-15038
BOSTON UNIV., MASS.
The bird: A pressure-confined explosion in the interstellar medium N87-15062
BRIGHAM YOUNG UNIV., PROVO, UTAH.
Curved silicon substrates for multilayer structures
[DE86-013305] N87-14983
Design and fabrication of heat resistant multilayers
[DE86-013306] N87-14984
Theoretical considerations in the design of multilayer X-ray optics
[DE86-013307] N87-14985
BRITISH AEROSPACE AIRCRAFT GROUP, BRISTOL (ENGLAND).
First International Conference Materials in Aerospace
[BAE-S85/AMR/0080] N87-14243
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Theory of environmental effects on transgranular fracture
[DE86-016165] N87-14502
Neutron star formation in theoretical supernovae. Low mass stars and white dwarfs
[DE86-016168] N87-15135
BROWN, BOVERI UND CIE, A.G., BADEN (SWITZERLAND).
Vortex breakdown in technology and nature N87-14638
Vortex breakdown theories N87-14639
BROWN, BOVERI UND CIE, A.G., HEIDELBERG (WEST GERMANY).
Development of sodium/sulfur batteries, phase 3
[BMFT-FB-T-86-059] N87-14779
BROWN UNIV., PROVIDENCE, R. I.
The three dimensional stress intensity factor due to the motion of a load on the faces of a crack
[AD-A170135] N87-14732
Limiting behavior of linearly damped hyperbolic equations
[AD-A170161] N87-14920
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations
[AD-A170187] N87-14921
Interaction of diffusion and boundary conditions
[AD-A170217] N87-14922
Picosecond nonlinear resonant interactions in semiconductors
[AD-A170860] N87-15013
BUNDESANSTALT FUER FLUGSICHERUNG, FRANKFURT AM MAIN (WEST GERMANY).
Activities report in air traffic control
[ETN-87-98861] N87-14309
BUNDESMINISTERIUM DER VERTEIDIGUNG, BONN (WEST GERMANY).
Investigations on interactions between the fine motor control of the hand and achievements of attentiveness in airman typical problems
[REPT-2/85] N87-14851

C

CALIFORNIA INST. OF TECH., PASADENA.
A report summary of activities and results related to adhesive bonding
[AD-A173208] N87-14528
A compact density condensation around L1551-IRS 5: 2.7mm continuum observations with 4' resolution N87-15047
Are young stars always associated with cold massive disks? A CO and millimeter interferometric continuum survey N87-15051
HC3N maps of OMC1 N87-15056
High-resolution mapping of mass loss from highly evolved carbon stars N87-15077
CALIFORNIA UNIV., BERKELEY.
Design of thin-gap channel flow cells
[DE86-016159] N87-14609
FUSE/Lyman grant
[NASA-CR-180024] N87-14972
Numerical simulations of turbulent trapping in the weak beam-plasma instability
[AD-A170108] N87-15001
Near-infrared observations of IRAS sources in and near dense cores N87-15061
Spectral evolution of young stellar objects N87-15066
Aperture synthesis observations of the molecular ring in the galactic center N87-15083
Effects of stellar outflows on interstellar sulfur oxide chemistry N87-15121
CALIFORNIA UNIV., IRVINE.
Conceptual clustering using relational information
[AD-A170874] N87-14911
Dynamic formation of stressed coronal magnetic fields
[AD-A170176] N87-15153
CALIFORNIA UNIV., LOS ANGELES.
Comparison between electrodeposited aggregates in two dimensions and the fractal pattern calculated by the Witten-Sander model
[AD-A169495] N87-14490
Performance evaluation and control of distributed computer communication networks
[AD-A170810] N87-14579
Medium range (10 day) forecasts with the UCLA general circulation model
[AD-A170188] N87-14811
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003
Novel Si-based materials and device structures by molecular beam epitaxy
[AD-A170061] N87-15009
Planetary nebulae and the interstellar medium N87-15076
CALIFORNIA UNIV., SANTA BARBARA.
Stratification phenomena and associated hazards N87-14549
Steam explosions and associated hazards N87-14550
Development of a planar heterojunction bipolar transistor for very high speed logic
[AD-A170063] N87-15010
CAPE TOWN UNIV. (SOUTH AFRICA).
A comparison of trace element analysis of whole coal by INAA and XRFS N87-14460
CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Polymer precursors for ceramic matrix composites
[NASA-CR-179562] N87-14434
Proceedings of the Asilomar Conference on Polymers (9th) held on February 9-12, 1986 at Asilomar, California
[AD-A170066] N87-14522
CENTER FOR MATHEMATICS AND COMPUTER SCIENCE, AMSTERDAM (NETHERLANDS).
The cleaning person algorithm
[CWI-CS-R8610] N87-14889
The power of the queue
[CWI-CS-R8612] N87-14890
Knowledge representation and inference in rule-based systems
[CWI-CS-R8613] N87-14891
A general object-centered database language (GODEL): A preliminary definition
[CWI-CS-R8615] N87-14892
PROLOG: An expert system building tool
[CWI-CS-R8616] N87-14893
Module algebra
[CWI-CS-R8617] N87-14894
Algebraic specifications of computable and semicomputable data types
[CWI-CS-R8619] N87-14895
NUMVEC FORTRAN library manual. Chapter: Simultaneous linear equations
[CWI-NM-R8614] N87-14896
Distributed control in computer networks and cross sections of colored multidimensional bodies
[CWI-CS-R8611] N87-14906
Lower bounds for a class of Kostka numbers
[CWI-CS-R8614] N87-14925
On the mathematical synthesis of physiological and behavioral mechanisms and population dynamics
[CWI-AM-R8601] N87-14926
NUMVEC FORTRAN library manual. Chapter: Parabolic Partial Differential Equations (PDEs). Routine: Backward differentiation multigrid (BDMG)
[CWI-NM-R8610] N87-14927
Phase lag analysis of implicit Runge-Kutta methods
[CWI-NM-R8612] N87-14928
Stabilization of the Lax-Wendroff methods and a generalized one-step Runge-Kutta method for hyperbolic initial-value problems
[CWI-NM-R8613] N87-14929
Equilibrium and extinction in stochastic population dynamics
[CWI-AM-R8602] N87-14946
Intertwining functions in compact Lie groups and multivariable orthogonal polynomials
[CWI-PM-R8601] N87-14952
Deformations of connections, the Riemann Hilbert problem and tau functions
[CWI-PM-M8602] N87-14953
Constrained normalization of Hamiltonian systems and perturbed Keplerian motion
[CWI-PM-R8603] N87-14954
Multigrid solution of monotone second-order discretizations of hyperbolic conservation laws
[CWI-NM-R8611] N87-14955
CENTRAL ELECTRICITY GENERATING BOARD, LONDON (ENGLAND).
The influence of creep on the precipitate structure under conditions of long-term creep. Part 3: Investigation of ferritic model steels
[BLL-CE-TRANS-8252-(9022.09)] N87-14481
CENTRE D'ESSAIS AERONAUTIQUE TOULOUSE (FRANCE).
Behavior of composite materials subjected to a thermohygrometric cycle environment combined with mechanical fatigue. The case of a bolted joint and perforated specimens subjected to a supersonic military aircraft type mission, test report
[REPT-M1-538300] N87-14444
Elementary characterization of the AS4/2220.3 Hercules prepreg
[CEAT-M4-475-000] N87-14448
Physical-chemical characterization of the 2220-3 resin in the AS4/2220-3 preimpregnated material, test report, part 1
[REPT-M4-475000-PT-1] N87-14533
CENTRE D'ETUDES ET DE RECHERCHES PSYCHOLOGIQUES AIR, SAINT CYR (FRANCE).
Pilot aptitude evaluation simulator
[ETN-86-98433] N87-14852
CENTRE NATIONAL D'ETUDES SPATIALES, PARIS (FRANCE).
Fluid dynamic problems in the HM60 (Vulcain) cryogenic turbopump N87-14399
CENTRE NATIONAL D'ETUDES SPATIALES, TOULOUSE (FRANCE).
Optical intersatellite links. Performance comparison for on-off keying and M-PPM position modulation
[CNES-CT/DRT/TIT/TR-154-T] N87-14584
Marginal ice zone experiment (MIZEX) 1986 VARAN-S data set
[CNES-85/187T/CT/DRT/TIT/RL] N87-14828

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MEUDON-BELLEVUE (FRANCE).
Dynamic aspects of rocket plume impingement N87-14404
CENTRE NATIONAL DE RECHERCHES DE L'ESPACE, BRUSSELS (BELGIUM).
Space research in Belgium
[ISSN-0772-9804] N87-15159
CENTRE TECHNIQUE DES INDUSTRIES MECANIQUES, NANTES (FRANCE).
Analysis of abrasion and corrosion behavior of screws and cylinders in thermoplastic transformation machines
[CETIM-12-B-162] N87-14445
CENTRE TECHNIQUE DES INDUSTRIES MECANIQUES, SENLIS (FRANCE).
Ionic deposits
[CETIM-12-F-362] N87-14504
Hot forming of thick plates
[CETIM-13-J-122] N87-14505
Study and implementation of torque wrench calibrating apparatus
[CETIM-103-480] N87-14679
Tools for high velocity surface milling of steels
[CETIM-106030] N87-14710
Eddy current automation. Discrimination and selection software applied to hardness control
[CETIM-100-090] N87-14722
CENTRE TECHNIQUE DES INDUSTRIES MECANIQUES, ST. ETIENNE (FRANCE).
Analysis of some aspects of mechanical manufacturing automation
[CETIM-102700] N87-14709
CHICAGO UNIV., ILL.
On the interpretation of the beta(sub p) relation in interstellar clouds N87-15126
Magnetic braking in weakly ionized circumstellar disks N87-15129
CHRISTIAN ROVSING LTD., COPENHAGEN (DENMARK).
Dynamic Current Detector (DCD)
[SD/REPO/0001] N87-14610
CITY COLL. OF THE CITY UNIV. OF NEW YORK.
Picosecond and femtosecond spectroscopic instrumentation for ultrafast spectroscopy and lasers
[AD-A170126] N87-14691
CIVIL AVIATION AUTHORITY, LONDON (ENGLAND).
Reliability of in-service inspection of transport aircraft structures
[CAA-PAPER-85013] N87-14244
Analysis of bird strikes reported by European airlines 1976-1980. Civil aircraft over 5700 kg (12 500 lb) maximum weight
[CAA-PAPER-84019] N87-14296
Accidents to UK aircraft and to large jet and turbo-prop transport aircraft worldwide in 1984
[CAA-PAPER-85009] N87-14297
Human factors in accidents due to controlled flight into the ground
[CAA-PAPER-85015] N87-14298
Analysis of bird strikes to United Kingdom registered aircraft 1983 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-85018] N87-14299
Wind shear and flight safety: A select bibliography
[CAA-PAPER-86003] N87-14300
Accidents to United Kingdom aircraft and to large jet and turbo-prop transport aircraft worldwide in 1985
[CAA-PAPER-86005] N87-14301
Analysis of bird strikes to United Kingdom aircraft 1984 (civil aircraft over 5700 kg maximum weight)
[CAA-PAPER-86006] N87-14302
Auditory warnings on the BAC 1-11 and the Boeing 747. An application of the guidelines of CAA Paper 82017
[CAA-PAPER-85004] N87-14303
Survey of track keeping and altitudes on Heathrow and Gatwick Standard Instrument Departure routes
[CAA-PAPER-84018] N87-14308
Report of the Working Group on Helicopter Health Monitoring
[CAA-PAPER-85012] N87-14313
United Kingdom aircraft noise index study: Main report
[DR-8402] N87-14780
Noise disturbance at night near Heathrow and Gatwick airports: 1984 check study
[DR-8513] N87-14781
CEC joint study of community response to aircraft noise 1984: Main report. The influence of residual noise on disturbance from aircraft noise
[DR-8601] N87-14782
Helicopter passenger weigh survey, conducted at Aberdeen Airport, November 1984
[CAA-PAPER-85005] N87-14853
CLEMSON UNIV., S.C.
Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen
[DE86-013217] N87-14538
COAST GUARD RESEARCH AND DEVELOPMENT CENTER, GROTON, CONN.
An evaluation of the hypothesis that laser light is more conspicuous than incandescent light
[AD-A170823] N87-14695
COLORADO STATE UNIV., FORT COLLINS.
Carbon whisker study
[AD-A170345] N87-15012
COLORADO UNIV., BOULDER.
State-resolved dynamics of ion-molecule reactions in a flowing afterglow
[AD-A170839] N87-14796
Neutral hydrogen cloud distances and the strength of the interstellar magnetc field N87-15086
The ultraviolet extinction in M-supergiant circumstellar envelopes N87-15112
Molecular catastrophes and the formation of circumstellar dust N87-15116
Interstellar absorption lines in the spectrum of sigma Sco using Copernicus observations N87-15122
COMMISSARIAT A L'ENERGIE ATOMIQUE, FONTENAY-AUX-ROSES (FRANCE).
Formation and dynamics of aerosols N87-14546
Transport of toxic material in aerosol phase N87-14547
COMMISSARIAT A L'ENERGIE ATOMIQUE, GIF-SUR-YVETTE (FRANCE).
Numerical modeling of aerosols N87-14548
Non-equilibrium ionization around clouds evaporating in the interstellar medium N87-15073
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION (U. S. SENATE).
Space shuttle accident
[S-HRG-99-967] N87-14369
Report of the National Commission on Space
[S-HRG-99-954] N87-15028
COMMUNICATIONS RESEARCH CENTRE, OTTAWA (ONTARIO).
Electric propulsion: A review of future space propulsion technology
[CRC-1396] N87-14421
CONNECTICUT UNIV., STORRS.
Field study of wind through and over a forest edge
[AD-A169491] N87-14809
CONSTRUCCIONES AERONAUTICAS S.A., MADRID (SPAIN).
Low contraction additives for polyester resins
[ETN-86-98563] N87-14535
Results of the tests carried out to study the physical parameters affecting the ultrasonic inspection made by transmission under water jet (SIRO), part 1
[I-114/85-PT-1] N87-14723
Results of the tests carried out to study the physical parameters affecting ultrasonic inspection made by transmission under water jets (SIRO), part 2
[I-126/85-PT-2] N87-14724
Ultrasonic inspection of hinge support number 5
[I-129/85] N87-14725
CORNELL UNIV., ITHACA, N.Y.
Mechanistic understanding of powder compaction in metals
[AD-A170800] N87-14495
Study of phenomena of unsteady boundary-layer separation
[AD-A170428] N87-14649
Laser-surface adsorbate interactions: Thermal vs. Photoelectronic excitation of Mo(Co)6 onSi(3)
[AD-A169641] N87-14964
CORNING GLASS WORKS, N.Y.
Fluoride glasses for bulk optical and waveguide applications
[AD-A170750] N87-14526
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA).
Research activities of the National Institute for Materials Research, 1985
[DE86-702765] N87-14436

D

DACCA UNIV. (BANGLADESH).
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
DACCA UNIV. (PAKISTAN).
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499
DAIMLER-BENZ A.G., STUTTGART (WEST GERMANY).
Possibilities and problems of the calculation of flow phenomena in combustion chambers
[ETN-86-98745] N87-14713
DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA).
Visual sensitivities and discriminations and their roles in aviation
[AD-A170418] N87-14849
DANISH METEOROLOGICAL INST., COPENHAGEN.
Thule magnetic results, 1981
[ISBN-87-7478-263-0] N87-14799
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[ISBN-87-7478-266-5] N87-14801
The ice conditions in the Greenland waters, 1979
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DANISH SPACE RESEARCH INST., LYNGBY.
Rocket observation of E-B-field correlations showing up- and downgoing Poynting flux during an auroral breakup event
[REPT-7-86] N87-14791
A new method for measuring space plasma current densities by the Faraday rotation of laser light in optical monomode fibers
[REPT-4-86] N87-14696
DAYTON UNIV., OHIO.
The 7th Symposium on Applied Surface Analysis
[AD-A169640] N87-14469
DEFENCE RESEARCH ESTABLISHMENT VALCARTIER (QUEBEC).
Measurement of the frequency shift at the peak of the P20 line of a CO2 waveguide laser
[AD-A170318] N87-14693
DEFENCE RESEARCH INFORMATION CENTRE, GLASGOW (SCOTLAND).
Recent progress in the field of cathodic protection
[DRIC-T-7657] N87-14485
DEFENCE RESEARCH INFORMATION CENTRE, ORPINGTON (ENGLAND).
Methods of remote evaluation of chlorophyll concentration in the sea
[DRIC-T-7652] N87-14824
A model of typing performance with respect to mental load factors
[DRIC-T-7770] N87-14844
DELAWARE UNIV., NEWARK.
Turbulence modeling for steady three-dimensional supersonic flows
[AD-A170042] N87-14285
DELPHI RESEARCH, INC., ALBUQUERQUE, N. MEX.
Hydrogen production with the electrocatalytic oxidation system
[PB86-223898] N87-14540
DEPARTMENT OF COMMUNICATIONS, OTTAWA (ONTARIO).
Development of the design concept for a variable rate system for the 30/20 GHz Olympus trial N87-14565
DEPARTMENT OF ENERGY, WASHINGTON, D. C.
Five Year Research and Development Plan, 1986-1990. National Solar Thermal Technology Program
[DE86-013644] N87-14772
DEPARTMENT OF THE AIR FORCE, WASHINGTON, D.C.
Spacecraft subsystem support structure
[AD-D012437] N87-14576
Magnetic bias and delay linearity in a magnetostatic wave delay line
[AD-D012526] N87-14654
Optical Gaussian convolvers
[AD-D012438] N87-14976
DEPARTMENT OF THE ARMY, WASHINGTON, D. C.
A log - periodic HF antenna system
[AD-D012527] N87-14581
Electrical receptacle
[AD-D012528] N87-14606
Dual battery connector arrangement
[AD-D012544] N87-14607
DEPARTMENT OF THE NAVY, WASHINGTON, D. C.
Electric wave device and method for efficient excitation of an dielectric rod
[AD-D012430] N87-14575
Non-aqueous primary cell
[AD-D012428] N87-14599
Quantum well electron barrier diode
[AD-D012432] N87-14600
Minimum inductance laser head for pulsed transverse discharges without wall tracking
[AD-D012429] N87-14694
DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK (WEST GERMANY).
A calculation method for the propulsive jet and its aerodynamic interaction with an afterbody
[DFVLR-FB-86-29] N87-14292
Proceedings of a Structural Mechanics Colloquium of Nondestructive Testing of Fiber Reinforced Structures
[DFVLR-MITT-86-09] N87-14437

Nondestructive tests of Carbon Fiber Reinforced Plastics (CFRP) in the framework of damage mechanics investigations N87-14438
Ultrasonic testing for damage analysis of Carbon Fiber Reinforced Plastics (CFRP) laminates N87-14439
Acoustic emission analysis of Carbon Fiber Reinforced Plastics (CFRP) N87-14440
X-ray tests, measurements with an optical reflection method, and destructive tests as a tool for damage mechanics investigations N87-14441
Laboratory tests of the sensors of the Steinheil-Lear Siegler Strapdown Measurement Unit model 1903-SB for model attitude measurements in a wind tunnel
[DFVLR-MITT-86-15] N87-14682
Initiation and propagation of cracks in notched unidirectional laminates of carbon fiber reinforced epoxy under static tensile load
[DFVLR-FB-86-30] N87-14751
Noise certification and noise sensitivity studies on the BO-105 helicopter
[DFVLR-MITT-86-13] N87-14958

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, GOETTINGEN (WEST GERMANY).
Experience about the application and valuation of roughness strips for boundary layer transition control in wind tunnel tests in the high-speed range
[DFVLR-MITT-86-12] N87-14291
Laboratory simulation of the real gas effects of reentry N87-14396
Rocket exhaust plume flow into space N87-14403
Experimental investigations on the stability and transition of three-dimensional boundary layers
[DFVLR-FB-86-24] N87-14664
An experimental investigation of noise generation and noise reduction in a pipe flow behind a discontinuous area enlargement
[DFVLR-FB-86-27] N87-14959

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, HARDTHAUSEN (WEST GERMANY).
Winged space transporters: The problem of the number of stages
[ETN-87-98863] N87-14367

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN (WEST GERMANY).
Error analysis of SAR hardware
[DFVLR-FB-86-26] N87-14591
Investigations on a broadband 180 deg hybrid
[DFVLR-FB-86-22] N87-14616
Forcing mechanisms of mountain-valley circulations in the Inn-Valley (Alps)
[DFVLR-FB-86-28] N87-14802

DEUTSCHE GEODAETISCHE KOMMISSION, MUNICH (WEST GERMANY).
German-Austrian stellar triangulation project using balloon sondes
[SER-B-278] N87-14758
German-Austrian stellar triangulation project using balloon sondes. Development and purpose of the project N87-14759
German-Austrian stellar triangulation project using balloon sondes. Engineering and observations N87-14760
German-Austrian stellar triangulation project using balloon sondes. Evaluation of observations and analysis of the results N87-14761
An extended mathematical model of aerotriangulation for highly precise point determination
[SER-C-316] N87-14762
Construction of a digital height model based on simple finite elements
[SER-C-315] N87-14763

DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN (WEST GERMANY).
Packet telemetry
[MATRA-RF/176/0898-ISSUE-1-REV.] N87-14371
Heat pipe experiment on SPAS 01 N87-14411
Life support and energy supply systems for manned European return spacecraft (technological requirements)
[ETN-87-98860] N87-14860

DOW CORNING CORP., MIDLAND, MICH.
Novel silane and disilane precursors to amorphous semiconductors
[DE86-010734] N87-15016

DUKE UNIV., DURHAM, N. C.
Do large rate coefficients for ion-polar neutral reactions have a serious effect on chemical models of dense clouds? N87-15118

DURHAM UNIV. (ENGLAND).
Observational discrimination between modes of shock propagation in interstellar clouds: Predictions of CH+ and SH+ column densities in diffuse clouds N87-15081

DYNAMIC RESEARCH, INC., TORRANCE, CALIF.
Supplementary report on antilock analyses
[NASA-CR-179955] N87-14703

E

ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES, PARIS (FRANCE).
Activities report of the Laboratory of Mechanics and Energy Studies
[ETN-87-98577] N87-14558

ECOLE NATIONALE SUPERIEURE DES TELECOMMUNICATIONS, PARIS (FRANCE).
Modeling of telecommunication systems operated with advanced capacity reservation
[ENST-86E006] N87-14586
Distributed charge model MOS transistors
[ENST-86D003] N87-15019

ECOLE NORMALE SUPERIEURE, PARIS (FRANCE).
Identification of polycyclic aromatic hydrocarbons N87-15098

EDGERTON, GERMESHAUSEN AND GRIER, INC., GOLETA, CALIF.
Wavelength-multiplexed imaging techniques using optical fibers
[DE86-013028] N87-14986

EDGERTON, GERMESHAUSEN AND GRIER, INC., IDAHO FALLS, IDAHO.
Human factors guidelines and methodology in the design of a user computer interface: A case study
[DE86-013470] N87-14858

EEG SYSTEMS LAB., SAN FRANCISCO, CALIF.
Neurocognitive pattern analysis of auditory and visual information
[AD-A170202] N87-14847

EG AND G ENERGY MEASUREMENTS, INC., LAS VEGAS, NEV.
Unique coupler evaluation techniques and results
[DE86-012101] N87-14982

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE. ZURICH (SWITZERLAND).
Laser-photoacoustic spectroscopy of air pollutants
[M-19] N87-14787

ELORET CORP., SUNNYVALE, CALIF.
Structural characterization and gas reactions of small metal particles by high resolution in-situ TEM (Transmission Electron Microscopy) and TED (Transmission Electron Diffraction)
[NASA-CR-180020] N87-14466

ENVIRONMENTAL PROTECTION AGENCY, RESEARCH TRIANGLE PARK, N.C.
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823

ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.
Reduced tolerance imaging I
[AD-A170932] N87-14882

EOTVOS LORAND UNIV., BUDAPEST (HUNGARY).
Optimization of spectrographic trace analysis N87-14455

ERNO RAUMFAHRTTECHNIK G.M.B.H., BREMEN (WEST GERMANY).
Electrothermal gas generator: Development and qualification of the control electronics
[BMFT-FB-W-86-006] N87-14611
Vacuum Superinsulation (VSI) elements for cover in large heat storage systems
[BMFT-FB-T-86-007] N87-14778
Evaluation of methods for coordination of software technological tasks using examples of the Spacelab program and air surveillance program. Part 3: Experience report for a software project for air surveillance
[BMFT-FB-DV-86-005] N87-14898

EUROPEAN SPACE AGENCY, PARIS (FRANCE).
Investigation of Ferri instability in supersonic inlets
[ESA-TT-978] N87-14289
Flow field measurements in the 3m x 3m low speed wind tunnel (NWG) of the DFVLR in Goettingen (West Germany)
[ESA-TT-981] N87-14290
Direct calculation of wall interferences and wall adaptation for two-dimensional flow in wind tunnels with closed walls
[ESA-TT-989] N87-14295
Results of icing flights in winter 1983/1984: Ice accretion thickness in correlation with cloud physical parameters, object and cloud parameters
[ESA-TT-969] N87-14324
Calculation of ice accretion on cylindrical rods according to Bain's model and comparison with experimental results
[ESA-TT-970] N87-14325
The icing research aircraft Do28, D-IFMP of DFVLR and its measuring equipment
[ESA-TT-972] N87-14326
Theoretical and experimental investigations of flow vector measurements with angle-of-attack and sideslip sensors on DFVLR meteorological research aircraft
[ESA-TT-976] N87-14327
A contribution to digital compensation of periodic disturbances with frequencies in bounded intervals
[ESA-TT-979] N87-14352
Proceedings of an International Symposium on Fluid Dynamics and Space
[ESA-SP-265] N87-14394
Analysis and optimization of small space shuttle propulsion platforms
[ESA-TT-901] N87-14430
Fade countermeasures for satellite communications
[ESA-STM-235] N87-14560
Alleviation of fading effects in radiopaths by fade-spreading N87-14561
Adaptive transmission rate and variable redundancy systems as a fade countermeasure N87-14562
Adaptive TDMA as a means of trading power against bandwidth N87-14563
Uplink power control of satellite Earth stations as a fade-countermeasure of 20/30 GHz communication systems N87-14564
Development of a linear backfire antenna for an airborne L-band scatterometer
[ESA-TT-986] N87-14590
Scattering by complicated structures: Calculation of the radar properties of metallic targets by means of physical optics
[ESA-TT-946] N87-14593
Main types of free separation in model ellipsoids
[ESA-TT-990] N87-14662
Instationary flow effects in the rotor of a turbine
[ESA-TT-1001] N87-14663
Numerical study of the laminar shock-boundary layer interaction
[ESA-TT-958] N87-14665
Investigation of large scale structures in a subsonic free jet
[ESA-TT-962] N87-14666
A direct method for evaluating the disturbance fields of moving singularities at subsonic speeds in compressible media
[ESA-TT-977] N87-14667
Criteria for separation in two-dimensional steady and unsteady compressible flow
[ESA-TT-985] N87-14668
Investigations on laser mirrors of differing coating structure
[ESA-TT-991] N87-14702
Balancing of a rod using a digitally controlled robot
[ESA-TT-966] N87-14717
Remote sensing for advanced land applications
[ESA-SP-1075] N87-14770
Determination of atmospheric parameters by an airborne backscatter probe
[ESA-TT-982] N87-14822
On the effects of X irradiation on Bacillus Subtilis spores in a dry and wet system
[ESA-TT-968] N87-14834
Visibility of signal lights under atmospheric effects
[ESA-TT-987] N87-14992
Setup for determining the reflectivity of interference coatings
[ESA-TT-997] N87-14993
Construction of fiber optics two-beam interferometers and investigations of the strain and temperature sensitivity
[ESA-TT-980] N87-14994
Microprocessor controlled optical measuring system for large mirror modules
[ESA-TT-984] N87-14995

EUROPEAN SPACE AGENCY. EUROPEAN SPACE RESEARCH AND TECHNOLOGY CENTER, ESTEC, NOORDWIJK (NETHERLANDS).
Fluid dynamic problems in space systems N87-14402

F

FACHHOCHSCHULE, HAMBURG (WEST GERMANY).
A method for the interpretation of gravity anomalies using three-dimensional modeling
[BMFT-FB-T-86-020] N87-14797

FAIRCHILD INDUSTRIES, INC., FARMINGDALE, N.Y.
Assessment of damage tolerance requirements and analysis, task 1 report. Volume 2: Analytical methods
[AD-A170327] N87-14319

FLORIDA STATE UNIV., TALLAHASSEE.
Polymers in mechanochemical systems: Structure-property requirements
[DE86-014306] N87-14530
Easily stated but hard statistical problems
[AD-A170057] N87-14935
Stationary Markov sets
[AD-A170109] N87-14938
FLUGHAFEN, FRANKFURT AM MAIN (WEST GERMANY).
The simulator: The perfect illusion
[FACHTHEMEN-9] N87-14354
FOM-INST. VOOR PLASMAFYSICA, RIJNHUIZEN, JUTPHAAS (NETHERLANDS).
Calibration of the fast 12-channel Electron Cyclotron Emission (ECE) spectrometer at Joint European Torus (JET)
[REPT-86-168] N87-14970
FORSCHUNGSINSTITUT DER DEUTSCHEN BUNDESPOST, DARMSTADT (WEST GERMANY).
Design of filters for the vertical subsampling of color difference signals at half the sampling rate
[FI-447-TB-19] N87-14587
FORSCHUNGSINSTITUT FUER INFORMATIONSVERARBEITUNG, KARLSRUHE (WEST GERMANY).
Integration of artificial intelligence concepts into the methods for extracting line objects from monochromatic aerial imagery
[AD-A170884] N87-14767
FRAUNHOFER-INST. FUER ANGEWANDTE FESTKOERPERPHYSIK, FREIBURG (WEST GERMANY).
Liquid crystal materials and electrooptic effects for high information content displays
[BMFT-FB-T-86-018] N87-14986
FRAUNHOFER INST. FUER WERKSTOFFMECHANIK, FREIBURG (WEST GERMANY).
Experimental investigations of dynamic effects in impact tests
[W-1/85] N87-14749
Activities report in materials mechanics
[ISSN-0713-9956] N87-14750
Numerical simulations of impact tests on elastoplastic materials
[REPT-W-5/86] N87-14753
Applicability and limitations of probabilistic models in connection with the reliability of large installations
[W-7/85] N87-14948
FREIBURG UNIV. (WEST GERMANY).
Growth of a silicon single crystal by the floating-zone technique under micro-g conditions during Spacelab 1
[BMFT-FB-W-86-004] N87-14542
Preparation of a solvent zone crystallization experiment of cadmium telluride during the First SpaceLab Project (FSLP) Spacelab mission
[BMFT-FB-W-86-005] N87-14543
FREIE UNIV., BERLIN (WEST GERMANY).
Development of Test Reference Years (TRY) for climatic regions in the Federal Republic of Germany
[BMFT-FB-T-86-051] N87-14818
FULMER RESEARCH INST. LTD., STOKE POGES (ENGLAND).
An assessment of aircraft repair schemes for battle damage and permanent usage
[R946/8] N87-14246
FUNDACIO EMPRESA I CIENCIA, BARCELONA (SPAIN).
Stationkeeping of libration point orbits, executive summary
[ESA-CR(P)-2272] N87-14363

G

GARRETT TURBINE ENGINE CO., PHOENIX, ARIZ.
Scaled centrifugal compressor program
[NASA-CR-174912] N87-14349
Brayton cycle solarized advanced gas turbine
[NASA-CR-179559] N87-15030
GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
DOD (Department of Defense) acquisition: Case study of the Navy V-22 OSPREY Joint Vertical Lift Aircraft Program
[PB86-231388] N87-14315
DOD (Department of Defense) acquisition: Case study of the Air Force Space Based Space Surveillance System
[PB86-230620] N87-15023
GEORGIA INST. OF TECH., ATLANTA.
Evaluation of data on simple turbulent reacting flows
[AD-A170071] N87-14648
GEORGIA UNIV., ATHENS.
Coherent phonon generation and high frequency phonon spectroscopy
[AD-A169031] N87-14961
GESELLSCHAFT FUER SCHWERIONENFORSCHUNG M.B.H., DARMSTADT (WEST GERMANY).
Universal microcomputer for the control of electronic equipment
[GSI-86-12] N87-14870
GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H., MUNICH (WEST GERMANY).
NO2 conversion during the atmospheric dispersion of nitric oxides
[BPT-1/86] N87-14784
Determination of the technical degradation of nitrogen oxides in the atmosphere
[BPT-3/86] N87-14785
GKSS-FORSCHUNGSZENTRUM GEESTHACHT (WEST GERMANY).
Orbit calculation for artificial Earth satellites
[GKSS-86/E/21] N87-14365
Determination of the Crack Tip Opening Displacement (CTOD) and crack blunting (or Stretch Zone Width, SZW) using the J integral
[GKSS-86/E/15] N87-14752
GRENOBLE-1 UNIV. (FRANCE).
Cavitation research. Cavitation developed and boundary layers for the NACA 16-012 profile with oscillating incidence
[ETN-86-96436] N87-14287
Partial cavitation on pump blades N87-14401
HSURF: An easy-to-test microprocessor for high reliability applications
[ETN-87-96586] N87-14871
Systolic networks for the solution of linear problems
[ETN-87-96589] N87-14909
Formal calculus and number of roots of polynomials in the unit disk: Application to automatisms and biochemistry
[ETN-87-96587] N87-14931
Binary time series with reward. Application to climatology modeling
[ETN-87-96588] N87-14950
GRENOBLE-1 UNIV., SAINT MARTIN D'HERES (FRANCE).
Program synthesis = proof method + knowledge. Example of recursion function synthesis
[RR-605-IMAG-48-LIFIA-I] N87-14903
Performance of a pipeline array of automata with periodic cycle-time
[RR-607-IMAG-I] N87-14908
Location of the communication process network described in FP2 on a graph structure in order to implement the parallel processing of that language
[RR-606-IMAG-49-LIFIA-I] N87-14914
Order of strong convergence of least squares estimates in stochastic regression models for semimartingales
[RR-608-IMAG-M] N87-14949
GTE LABS., INC., WALTHAM, MASS.
Processing studies for optically transparent La(2)O(3)-doped Y(2)O(3)
[AD-A170821] N87-14979

H

HARRIS CORP., MELBOURNE, FLA.
Development of the 15 meter diameter hoop column antenna
[NASA-CR-4038] N87-14366
HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS, CAMBRIDGE, MASS.
A 43GHz VLBI mapping of SiO maser emission associated with Orion-KL IRC-2 N87-15054
Translucent molecular clouds: Theory and observations N87-15117
Magnetic field in molecular cloud cores: Limits on field strengths and linewidths N87-15127
HARVARD UNIV., CAMBRIDGE, MASS.
Tearing of circumferential cracks in pipes loaded by bending
[AD-A170429] N87-14734
Micromechanics 2
[AD-A170560] N87-14735
HAWAII UNIV., HONOLULU.
More interstellar emission features at 3.3-3.6 micrometers! N87-15100
Moderate spectral resolution observations of 3 micron absorption features in highly obscured objects N87-15106
HERZBERG INST. OF ASTROPHYSICS, OTTAWA (ONTARIO).
C3H2 observations as a diagnostic probe for molecular clouds N87-15053
HOECHST A.G., FRANKFURT AM MAIN (WEST GERMANY).
Thermohydraulics during venting of two-phase systems N87-14551
Two-phase flow through safety devices and valves N87-14552
HOESCH STAHL A.G., DORTMUND (WEST GERMANY).
Analysis of ferrous materials N87-14451
Investigation of the production of uncoated and coated sheet steel in a continuous annealing line
[BMFT-FB-T-86-021] N87-14508
HONEYWELL, INC., BLOOMINGTON, MINN.
A class of narrow band gap semiconducting polymers
[AD-A169507] N87-14520

I

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Study of information dissemination by satellite, volume 1
[ESA-CR(P)-2171-VOL-1] N87-14589
IIT RESEARCH INST., LANHAM, MD.
Ada (trade name) bibliography, volume 3
[AD-A169589] N87-14873
IKO SOFTWARE SERVICE G.M.B.H., STUTTGART (WEST GERMANY).
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[ESA-CR(P)-2222] N87-14901
ILLINOIS STATE WATER SURVEY, URBANA.
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[AD-A170317] N87-14812
ILLINOIS UNIV., CHAMPAIGN.
The event-related brain potential as an index of information processing and cognitive activity: A program of basic research
[AD-A170794] N87-14838
ILLINOIS UNIV., CHICAGO.
Optimal allocation of multistate components
[AD-A170081] N87-14937
ILLINOIS UNIV., URBANA.
Research on a new type of negative hydrogen ion source
[AD-A170066] N87-14965
The clumpy circumstellar medium around young supernova remnants N87-15079
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
Measurements of the low-wave-number structure of a turbulent boundary layer
[IC-AERO-85-01] N87-14657
Computational fluid dynamics in engineering and education
[CFDU/86/6] N87-14658
CFD in the automobile industry
[CFDU/86/7] N87-14659
INSTITUT DE MECANIQUE DES FLUIDES DE TOULOUSE (FRANCE).
Numerical simulation of turbulent structures in a mixing zone
[ETN-87-96582] N87-14660
INSTITUT FRANCO-ALLEMAND DE RECHERCHES, ST. LOUIS (FRANCE).
Measurement of the velocity and temperature of ignition gas and the role of the particles in the ignition mechanism
[ISL-CO-241/85] N87-14479
Measurement of the velocity and temperature of ignition gas jets in a bed of confined inert powder
[ISL-CO-245/85] N87-14480
Theoretical and experimental investigation of the turbulent boundary layer behind a piston in a tube
[ISL-CO-246/85] N87-14661
Progress in holographic cinematography
[ISL-CO-243/85] N87-14880
INSTITUT NATIONAL POLYTECHNIQUE, GRENOBLE (FRANCE).
Design of Programmable Logic Arrays (PLA) CMOS
[ETN-87-96590] N87-14617
Contribution to the study of a monolithic 32 bit processor in CMOS technology
[ETN-87-96592] N87-14618
Parallel algorithms: Automata networks, systolic architectures, SIMD and MIMD machines
[ETN-87-96591] N87-14904
INSTITUTE OF OCEANOGRAPHIC SCIENCES, WORMLEY (ENGLAND).
Dispersion of tracers by the oceanic eddy field modelling programme
[IOS-229] N87-14829
INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS (BRAZIL).
Nonsingular parametric expressions for orbit propagation by theoretical estimation of parameters
[INPE-4024-TDL/241] N87-14360

Evaluation of the burned area and regeneration of vegetation affected by the fire in the Parque Nacional de Brasilia through TM/LANDSAT data
[INPE-4035-RPE/522] N87-14764
Preliminary consideration on robustness of nonlinear discrete-time regulators
[INPE-4015-RPE/520] N87-14917
Pb(1-x) Sn(x)Te photovoltaic detectors and semiconductor lasers fabricated by liquid phase expitaxy
[INPE-3992-PRE/992] N87-15005

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS, TRIESTE (ITALY).
Temperature dependence of structural and transport properties of less-simple liquid metals
[DE86-702770] N87-14499
Model for bimetallic interfaces
[DE86-702901] N87-14500
Thermographic investigation on the thermoelastic effect in metals
[DE86-702986] N87-14501
Application of infrared technique in research of mechanical properties
[DE86-702769] N87-14741
Implications of the spatial finiteness of mesoscale meteorological fields
[DE86-702777] N87-14816
Polarizability of a crystal with impurities
[DE86-702900] N87-15014
Stark ladder density of states in a finite crystal
[DE86-702906] N87-15015
Possible evolution scheme for the universe in conformal gravity
[DE86-702715] N87-15132
Cosmic superstrings and related topics
[DE86-702738] N87-15133
Supergravification, phase transitions and cosmology
[DE86-702955] N87-15134

IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
Wing/body interference flow investigation
[NASA-CR-179979] N87-14278

J

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Degradation studies of SMRM Teflon N87-14392
User's introductory guide (HM-256)
[DE86-013002] N87-14886

JOHNS HOPKINS UNIV., LAUREL, MD.
Radiation effects on selected electronics parts from the solar max satellite N87-14377
Studies of erosion of solar max samples of Kapton and Teflon N87-14384

JOINT INST. FOR LAB. ASTROPHYSICS, BOULDER, COLO.
Supershells and propagating star formation N87-15067
IUE absorption studies of broad- and narrow-line gas in Seyfert galaxies N87-15084
Measuring interstellar grains from the haloes of binary X-ray sources N87-15115
IUE/IRAS studies of metal abundances and infrared cirrus N87-15124

K

KERNFORSCHUNGSANLAGE, JUELICH (WEST GERMANY).
Contributions to the Post CSI-Symposium of the 24th Colloquium Spectroscopicum Internationale on the Analysis of Materials (Metals, Ceramics, Minerals) using Spectroscopic Methods
[JUEL-CONF-55] N87-14450
Spectrochemical analysis of core materials for advanced high temperature reactors with process heat applications N87-14452
Potential of high temperature mass spectrometry for the analysis of materials N87-14453
Advanced chemical analysis service at the Nuclear Research Center, Juelich, West Germany N87-14454
Structural features of corundum color varieties by spectroscopic methods N87-14461
Applied system analysis no. 45: SOLARYS, an interactive model for the simulation of solar systems, parts 1 and 2
[JUEL-SPEZ-346-PT-1-PT-2] N87-14775
Determination of the technical degradation of nitrogen oxides in the atmosphere
[BPT-3/86] N87-14785
Investigations on dry deposition and emission of atmospheric NO, NO2 and HNO3 to and from natural surfaces
[JUEL-2054] N87-14788

KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY).
UNIGRAPH: A program system for graphic output, documentation and management of arbitrary, two-dimensional volumes of data
[KFK-4081] N87-14888

KIESERLING UND ALBRECHT WERKZEUGMASCHINENFABRIK, SOLINGEN (WEST GERMANY).
Development of a copy-peeling machine for machining the surface of hot rolled square billets
[BMFT-FB-HA-86-004] N87-14555

KMS FUSION, INC., ANN ARBOR, MICH.
Two-stage FEL (Free Electron Laser) research at KMS Fusion, Inc.
[AD-A170828] N87-14696

KOMENSKY UNIV., BRATISLAVA (CZECHOSLOVAKIA).
Study of the accuracy of spectrochemical trace element determinations in geological materials N87-14456

KONINKLIJKE/SHELL-LAB., AMSTERDAM (NETHERLANDS).
Discharges of saturated liquefied gases from pressure vessels N87-14545

KONSTANZ UNIV. (WEST GERMANY).
Development of new solar cells from polysilicon, silicon powder and new compound semiconductors suitable for thin film cells
[BMFT-FB-T-86-003] N87-14776

L

LANDESSTERNWARTE AUF DEM KOENIGSTUHL, HEIDELBERG (WEST GERMANY).
Unstable 06.5f?p star HD 148937 and its interstellar environment N87-15069

LAWRENCE LIVERMORE NATIONAL LAB., CALIF.
High bandwidth analog applications of photonics: Present capabilities and future possibilities
[DE86-014999] N87-14582
Pulse shaping with transmission lines
[DE86-013674] N87-14608
Postexperimental plots with a HP 7550A plotter
[DE86-015501] N87-14866
MORE operating system: A message oriented resource environment
[DE86-013932] N87-14887
Scaling of current density, total current, emittance, and brightness for hydrogen negative ion sources
[DE86-016010] N87-14967
Inertial fusion power for space applications
[DE86-011879] N87-14969
Strategic defense initiative and the prospects for international cooperation in space
[DE86-016153] N87-15029

LEADERSHIP AND MANAGEMENT DEVELOPMENT CENTER, MAXWELL AFB, ALA.
Compendium of research
[AD-A170356] N87-15024

LEHIGH UNIV., BETHLEHEM, PA.
A study of fatigue crack propagation in powder metallurgy hot isotatically pressed nickel-base alloy
[AD-A173211] N87-14497
Fatigue and fracture mechanics of structural metals, plastics, and composites
[AD-A173064] N87-14739

LEIDEN UNIV. (NETHERLANDS).
The organic component of interstellar grains N87-15114

LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.
Teflon, Kapton surface and bulk effects N87-14390
Solar maximum thermal surface assessment N87-14393

LOGICA LTD., LONDON (ENGLAND).
Rendezvous and docking (RVD) guidance simulation program, rider 2
[MATRA-EPT/DT/VT068/012] N87-14359

LONDON UNIV. (ENGLAND).
Far-infrared investigation of the Taurus star-forming region using the IRAS database N87-15044
MM and subMM molecular line observations of the southwest lobe of L1551: Evidence of a shell structure N87-15045
Submillimetre molecular line observations of M17: The interaction of an ionisation front and molecular clouds N87-15060

LOS ALAMOS NATIONAL LAB., N. MEX.
Zeeman Laser Scattering (ZLS): A new light scattering technique
[DE86-012443] N87-14700
Trilevel interaction design model for pilot part-task training
[DE86-012428] N87-14850
Riemann problems and their application to ultra-relativistic heavy ion collisions
[DE86-013829] N87-14966
Wavelength-multiplexed imaging techniques using optical fibers
[DE86-013028] N87-14986

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND).
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899

M

MARYLAND UNIV., COLLEGE PARK.
Autonomous vehicle navigation
[AD-A170379] N87-14311
Camera rotation invariance of image characteristics
[AD-A171615] N87-14883
A fast graphical goodness of fit test for time series models
[AD-A170094] N87-14919
Parallel matrix computations
[AD-A170699] N87-14923
Random field identification from a sample. 1: The independent case
[AD-A170185] N87-14943

MASCHINENFABRIK AUGSBURG-NUERNBERG A.G., MUNICH (WEST GERMANY).
German-Korean cooperation for erection and test of industrialized solar technologies
[BMFT-FB-T-86-006] N87-14777

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
A study of the microstructure of a rapidly solidified nickel-base superalloy modified with boron
[NASA-CR-179553] N87-14486
A study of the fatigue behavior of short cracks in nickel-based superalloys
[AD-A170199] N87-14492
High temperature properties and processes in ceramics: Thermomigration
[DE86-015035] N87-14531
Radar scene generation for tactical decision aids
[NASA-CR-180027] N87-14567
High spatial resolution passive microwave sounding systems
[NASA-CR-180025] N87-14568
Command-and-control (C2) theory: A challenge to control science
[AD-A171716] N87-14580
A survey of algorithms for integrating wafer-scale systolic arrays
[AD-A171623] N87-14602
Methodology verification of hierarchically described VLSI circuits
[AD-A171742] N87-14605
Calibration of ETS videotapes
[AD-A168888] N87-14677
Tests and interpretation of mixed mode 1 and 2 fully plastic fracture from simulated weld defects
[AD-A170644] N87-14736
Mixed mode 1 and 2 fully plastic crack growth
[AD-A170645] N87-14737
Shear band characterization of mixed mode 1 and 2 fully plastic crack growth
[AD-A170646] N87-14738
Development of ultrasonic modelling techniques for the study of seismic wave scattering due to crustal inhomogeneities
[AD-A170082] N87-14794
Improved signal delay bounds for RC tree networks
[AD-A169625] N87-14874
Tight bounds for minimax grid matching with applications to the average case analysis of algorithms
[AD-A169627] N87-14875
Analysis of simulated annealing for optimization
[AD-A170174] N87-14941
Growth of cadmium telluride under controlled heat transfer conditions
[AD-A170031] N87-15008
Dynamic image interpretation for autonomous vehicle navigation
[AD-A173209] N87-15033

MASSACHUSETTS INST. OF TECH., LEXINGTON.
The solar shield: A thermally insulating, broad-band, electromagnetic window for satellites
[AD-A170334] N87-14414

MASSACHUSETTS UNIV., AMHERST.
High resolution observations of the L1551 bipolar outflow N87-15046
CO mapping of the Orion molecular cloud: The influence of star formation on cloud structure N87-15057
The molecular gas in the supernova remnant IC443 N87-15060

Studies of interstellar vibrationally-excited molecules N87-15119
Multi-level study of C3H2: The first interstellar hydrocarbon ring N87-15120
Studies of radiative transfer in planetary atmospheres [NASA-CR-180021] N87-15149

MATERIALS QUALITY ASSURANCE DIRECTORATE, LONDON (ENGLAND).
The performance of zinc phosphate two-pack epoxy primers [MQAD-TP-917] N87-14514

MATRA ESPACE, PARIS-VELIZY (FRANCE).
Rendezvous and docking (RVD) guidance simulation program, rider 2 [MATRA-EPT/DT/VT068/012] N87-14359

MATRA ESPACE, TOULOUSE (FRANCE).
Packet telemetry [MATRA-RF/176/0898-ISSUE-1-REV.] N87-14371
Assessment of data handling configuration for onboard operating system definition, phase 2/3 [MATRA-RF/139/1096] N87-14867

MAX-PLANCK-INST. FUER FESTKOERPERFORSCHUNG, STUTTGART (WEST GERMANY).
Pressure decomposition of ores, slags and oxidic materials for Inductively Coupled Plasma (ICP) and Atomic Absorption Spectroscopy (AAS) analysis N87-14457

MAX-PLANCK-INST. FUER PHYSIK UND ASTROPHYSIK, GARCHING (WEST GERMANY).
New detector concepts [MPE-PAE/EXP-E1-164] N87-14683
Resonator internal absorption and nonlinear dynamics of multimode laser systems [MPE-197] N87-14684
Resonator internal absorption N87-14685
Dynamics of multimode lasers N87-14686
The X-ray and gamma-ray astronomy (including non-photon astronomy) [MPE-PREPRINT-58] N87-15039
Heterodyne spectroscopy of planetary and stellar atmospheres at a wavelength of 11 micrometers [MPE-198] N87-15040
Optically thin winds from neutron stars [MPE-PREPRINT-50] N87-15154
The 35 day cycle of Her X-1: Quality of the clock mechanism [MPE-PREPRINT-54] N87-15155
A spectral study of the persistent X-ray flux from 4U/MXB 1636-53 [MPE-PREPRINT-57] N87-15156

MAX-PLANCK-INST. FUER PLASMAPHYSIK, GARCHING (WEST GERMANY).
Antenna optimization for Alfven wave heating [IPP-4/228] N87-14592

MAX-PLANCK-INST. FUER QUANTENOPTIK, GARCHING (WEST GERMANY).
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions [DE86-014345] N87-15003

MAX-PLANCK-INST. FUER RADIOASTRONOMIE, BONN (WEST GERMANY).
6 CM OH absorption in megamaser galaxies N87-15095

MAX-PLANCK-INSTITUT FUER STROEMUNGSFORSCHUNG, GOETTINGEN (WEST GERMANY).
Investigations of the wake in a flow parallel to plates with blunt trailing edges [MPIS-3/1986] N87-14293
Shock oscillations in transonic nozzle flows [MPIS-7/1986] N87-14294
Inelastic scattering experiments for the investigation of the rotational excitational of O2, N2, CO, and NO molecules by Ar and Ne [MPIS-2/1986] N87-14475
Noise development in transonic flows at the impact of vortices on a profile leading edge [MPIS-5/1986] N87-14960
Spectroscopy of the phonons on noble gas surfaces using helium atomic beam scattering [MPIS-1/1986] N87-14968

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., BREMEN (WEST GERMANY).
Development of a technology for increasing payload of existing aircraft (NEW 2) [BMFT-FB-W-86-007] N87-14328
Prediction methods for the calculation of flow fields around reentry vehicles N87-14395
Preliminary results from the EMTE fuel slosh flight experiment N87-14410
Elucidation of the adhesion mechanisms in structural aluminum bondings [BMFT-FB-W-86-008] N87-14534

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH (WEST GERMANY).
Extendable nozzle for the HM60 rocket engine N87-14396

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., OTTOBRUNN (WEST GERMANY).
Combined spacecraft propulsion systems [ETN-87-98864] N87-14431

METALLGESELLSCHAFT, A.G., FRANKFURT AM MAIN (WEST GERMANY).
Testing of high alloy steels for new hydrometallurgical processes and chemical plants [BMFT-FB-T-86-055] N87-14506

MICHIGAN STATE UNIV., EAST LANSING.
Upper semicontinuity of attractors for approximations of semigroups and partial differential equations [AD-A170187] N87-14921

MICHIGAN UNIV., ANN ARBOR.
Dependence of C2 sub n(C2 sub t) in the atmospheric boundary layer on convectional meteorological variables [AD-A169478] N87-14808

MIDWEST RESEARCH INST., KANSAS CITY, MO.
Effects of 60 Hz fields on human health parameters [PB86-231297] N87-14835

MINISTRY OF DEFENCE, LONDON (ENGLAND).
Report of survey carried out at ARE south arm site Rosyth on 10-14 December 1984 to determine the levels of welding fume and gases to which operaters are being subjected [MOD-103/86] N87-14783

MINNESOTA UNIV., MINNEAPOLIS.
Cold atomic hydrogen in the inner galaxy N87-15085

MULLARD SPACE SCIENCE LAB., DORKING (ENGLAND).
Analysis of altimetry data from the Marginal Ice Zone Experiment, executive summary [ESA-CR(P)-2215] N87-14769

N

NAGOYA UNIV. (JAPAN).
Experimental evidence of MHD surface wave [ISSN-0469-4732] N87-14997

NATIONAAL INST. VOOR KERNFYSICA EN HOGE ENERGIEFYSICA, AMSTERDAM (NETHERLANDS).
Pulse amplifier with high common-mode rejection [DIGEL-70] N87-14615
BACON-52 single board controller [DIGEL-68] N87-14869

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Post-Challenger assessment of space shuttle flight rates and utilization [NASA-CR-180105] N87-14368

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.
Aeronautical Engineering: A continuing bibliography with indexes (supplement 207) [NASA-SP-7037(207)] N87-14245
Aerodynamic characteristics of general aviation at high angle of attack with the propeller slipstream [NASA-TM-88503] N87-14280
Vortex systems on slender rotating bodies and their effect on the aerodynamic coefficients [NASA-TM-86490] N87-14281
Accident of the DC-10 EC-DEG aircraft at Malaga on September 13, 1982 [NASA-TM-88007] N87-14305
An overview of the British Aerospace HOTOL transatmospheric vehicle [NASA-TM-88008] N87-14317
Deep stall characteristics of MU-300 [NASA-TM-88502] N87-14318
Extraterrestrial research in the Federal Republic of Germany [NASA-TM-88010] N87-14358
Effect of the raw material composition of fabrics on the Limiting Oxygen Index (LOI) [NASA-TM-88483] N87-14483
Electrochemical behavior of a titanium electrode in hydrazine solutions [NASA-TM-88538] N87-14484
Oxygen index: An approximate value for the evaluation of combustion characteristics [NASA-TM-88492] N87-14485
Space technology in Berlin. Volume 1: Ideas for the establishment of an institute for space processing technology [NASA-TM-87994] N87-14541
Cables and fire hazards [NASA-TM-88493] N87-14553
Study of double exposure holography of the 3-dimensional character of the flow around an airfoil profile in a wind tunnel [NASA-TM-88486] N87-14673
On contact problems of elasticity theory [NASA-TM-88491] N87-14729
On the pilot's behavior of detecting a system parameter change [NASA-TM-88536] N87-14846
Planetary exploration through year 2000, a core program: Mission operations [NASA-TM-89275] N87-15138
Geological-morphological description of the Sedna and Guinevre planitiae on Venus (photomap sheets B-11, B-20, B-21) [NASA-TM-88494] N87-15139
Geometric principles for constructing radar panoramas of the surface of Venus: Hypsometric features of the Moon and terrestrial planets [NASA-TM-88532] N87-15140
Structural ensembles of the north belt of Venus deformations and possible mechanisms of their formation [NASA-TM-88511] N87-15141
Phobos and Deimos: Satellites of Mars [NASA-TM-88016] N87-15142
Geological-morphological description of the Ishtar Terra (photomap of the Venusian surface sheet B-5) [NASA-TM-88497] N87-15143
The Lakshmi Plateau structure as an indicator of asthenosphere horizontal flows on Venus [NASA-TM-88507] N87-15144
The structure of the Ishtar Terra central and eastern parts and some tectonic problems of Venus [NASA-TM-88508] N87-15145
Stress on the surface of Venus: Analysis of data provided by Venera-15 and Venera-16 [NASA-TM-88509] N87-15146
Parquet: Regions of areal plastic dislocations (on Venus) [NASA-TM-88510] N87-15147
The planets of the Solar System [NASA-TM-88015] N87-15148

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
A verification of unsteady Navier-Stokes solutions around oscillating airfoils [NASA-TM-88341] N87-14279
Development of a portable precision landing system [NASA-TM-88247] N87-14310
Ceramic-ceramic shell tile thermal protection system and method thereof [NASA-CASE-ARC-11641-1] N87-14442
A numerical study of incompressible juncture flows [NASA-TM-88319] N87-14644
Applications of computer-graphics animation for motion-perception research [NASA-TM-88335] N87-14845
Adaptive inverse control for rotorcraft vibration reduction [NASA-TM-86829] N87-14910
Semi-implicit and fully implicit shock-capturing methods for hyperbolic conservation laws with stiff source terms [NASA-TM-89415] N87-14916
Summer School on Interstellar Processes: Abstracts of contributed papers [NASA-TM-88342] N87-15043
Grain processes in massive star formation N87-15063
Infrared spectra of WC10 planetary nebulae nuclei N87-15075
The possible existence of interstellar Polycyclic Aromatic Hydrocarbons (PAHs) in collected interplanetary dust particles N87-15099
Resolution of the 7.7 micrometers emission feature in NGC 7027 N87-15101
IRAS surface brightness maps of visible reflection nebulae: Evidence for non-equilibrium infrared emission N87-15103
The 3.1 micrometer ice band in infrared reflection nebulae N87-15108
Models for application of radiation boundary condition for MHD waves in collapse calculations N87-15128

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Proceedings of the SMRM Degradation Study Workshop [NASA-TM-89274] N87-14374
Report on SMRM C/P main electronics box component and materials degradation evaluations N87-14375
The Main Electronics Box (MEB) of the HAO coronagraph/polarimeter N87-14376
Analysis of DRIRU bearings and lubricant from solar max repair mission N87-14379
Post flight analysis of NASA standard star trackers recovered from the solar maximum mission N87-14382
Results of examination of materials from the solar maximum recovery mission N87-14383

Analysis of normal and transparent silver Teflon N87-14391
Low phase noise oscillator [NASA-CASE-GSC-13018-1] N87-14596
Method of fabricating an imaging X-ray spectrometer [NASA-CASE-GSC-12956-1] N87-14671
The Geoscience Laser Altimetry/Ranging System (GLARS) [NASA-TM-87803] N87-14667
The molecular content of the nearby galaxy from IRAS and HI observations N87-15067
Infrared studies of supernova remnants with the IRAS N87-15104
Spectral characteristics of dust in carbon rich objects N87-15113
Evolution and interaction of large interplanetary streams [NASA-TM-86192] N87-15131
Ephemeral active regions and coronal bright points: A solar maximum Mission 2 guest investigator study [NASA-CR-177900] N87-15150

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Foldable self-erecting joint [NASA-CASE-MSC-20635-1] N87-14373
Analysis of micrometeorite material captured by the solar max satellite N87-14385
Examination of returned solar-max surfaces for impacting orbital debris and meteoroids N87-14386
A preliminary report on the study of the impact sites and particles of the solar maximum satellite thermal blanket N87-14387
Acoustic emission frequency discrimination [NASA-CASE-MSC-20467-1] N87-14676
Real-time garbage collection for list processing [NASA-CASE-MSC-20964-1] N87-14863

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

High lift, low pitching moment airfoils [NASA-CASE-LAR-13215-1] N87-14282
Remote pivot decoupler pylon: Wing/store flutter suppressor [NASA-CASE-LAR-13173-1] N87-14314
Preliminary results of SMM exposed aluminized Kapton and silvered Teflon N87-14389
Synchronously deployable double fold beam and planar truss structure [NASA-CASE-LAR-13490-1] N87-14413
The 5-(4-Ethynylphenoxy) isophthalic chloride [NASA-CASE-LAR-13316-2] N87-14515
Acetylene (ethynyl) terminated polyimide siloxane and process for preparation thereof [NASA-CASE-LAR-13318-1] N87-14516
Double reference pulsed phase locked loop [NASA-CASE-LAR-13310-1] N87-14559
Vibration-free Raman Doppler velocimeter [NASA-CASE-LAR-13268-1] N87-14669
Device for quick changeover between wind tunnel force and pressure testing [NASA-CASE-LAR-13512-1] N87-14675
Parameter estimation problems for distributed systems using a multigrid method [NASA-CR-178194] N87-14862

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Spatially growing disturbances in a high velocity ratio two-stream, coplanar jet [NASA-TM-88922] N87-14283
Propagation of sound waves in tubes of noncircular cross section [NASA-TP-2601] N87-14284
Electric propulsion options for the SP-100 reference mission [NASA-TM-88918] N87-14422
The survivability of large space-borne reflectors under atomic oxygen and micrometeoroid impact [NASA-TM-88914] N87-14423
Liquid oxygen cooling of high pressure LOX/hydrocarbon rocket thrust chambers [NASA-TM-88805] N87-14426
High- and low-thrust propulsion systems for the space station [NASA-TM-88877] N87-14427
An analytical and experimental investigation of resistojet plumes [NASA-TM-88852] N87-14428
Substituted 1,1,1-triaryl-2,2,2-trifluoroethanes and processes for their synthesis [NASA-CASE-LEW-14345-1] N87-14432
New condensation polyimides containing 1,1,1-triaryl-2,2,2-trifluoroethane structures [NASA-CASE-LEW-14346-1] N87-14433
Nickel base coating alloy [NASA-CASE-LEW-13834-1] N87-14482
The cyclic stress-strain behavior of PWA 1480 at 650 deg C [NASA-TM-87311] N87-14483
The effect of laser glazing on life of ZrO2 TBCs in cyclic burner rig tests [NASA-TM-88821] N87-14487
The effect of Cr, Co, Al, Mo and Ta on a series of cast Ni-base superalloys on the stability of an aluminide coating during cyclic oxidation in Mach 0.3 burner rig [NASA-TM-88840] N87-14488
Estimation of high temperature low cycle fatigue on the basis of inelastic strain and strainrate [NASA-TM-88841] N87-14489
Fiber reinforced ceramic material [NASA-CASE-LEW-14392-1] N87-14517
High-temperature effect of hydrogen on sintered alpha-silicon carbide [NASA-TM-88819] N87-14518
A design concept for an MMIC microstrip phased array [NASA-TM-88834] N87-14569
Swept frequency technique for dispersion measurement of microstrip lines [NASA-TM-88836] N87-14597
A low-cost optical data acquisition system for vibration measurement [NASA-TM-88907] N87-14730
Solution of elliptic partial differential equations by fast Poisson solvers using a local relaxation factor. 2: Two-step method [NASA-TP-2530] N87-14918
Finite element modeling of electromagnetic propagation in composite structures [NASA-TM-88916] N87-14956
High-speed propeller noise predictions: Effects of boundary conditions used in blade loading calculations [NASA-TM-88913] N87-14957
Asymptotic analysis of corona discharge from thin electrodes [NASA-TP-2645] N87-14998
Advanced Stirling conversion systems for terrestrial applications [NASA-TM-88897] N87-15031

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Double window viewing chamber assembly [NASA-CASE-MFS-28057-1] N87-14355
SSM atomic oxygen reactions on Kapton and silverized Teflon N87-14388
Low loss injector for liquid propellant rocket engines [NASA-CASE-MFS-25989-1] N87-14420
Emitted vibration measurement device and method [NASA-CASE-MFS-25981-1] N87-14670
High-temperature, high-pressure optical cell [NASA-CASE-MFS-26000-1] N87-14971
Liquid encapsulated float zone process and apparatus [NASA-CASE-MFS-28144-1] N87-15004
Research and technology, fiscal year 1986, Marshall Space Flight Center [NASA-TM-86567] N87-15034

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.

Method of examining microcircuit patterns [NASA-CASE-NPO-16299-1] N87-14594
Active hold-down for heat treating [NASA-CASE-NPO-16892-1-CU] N87-14704
Passively activated prehensile digit for a robotic end effector [NASA-CASE-NPO-16766-1-CU] N87-14705

NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).

SIMPROP: A system for simple aerodynamic analysis of propellers in axial flow. Description of method and user's guide [NLR-TR-84128-U] N87-14288
Observations on behavior of liquid in weightlessness N87-14406
Numerical simulation of vortical flow N87-14640
Three-dimensional Euler flow simulation on a Cyber 205 vector computer [NLR-TR-85054-U] N87-14656
Modeling of fatigue crack growth in 7075-T651 aluminum alloy plate [NLR-MP-85082-U] N87-14744
CADISS: An onboard system for compression and decompression of imagery sensor signals [NLR-MP-85045-U] N87-14868

NATIONAL AEROSPACE LAB., TOKYO (JAPAN).

Proceedings of the 3rd NAL Symposium on Aircraft Computational Aerodynamics [NAL-SP-5] N87-14247
Numerical simulation of an aircraft icing N87-14248
Numerical analysis of nozzle and free-jet flows of particle mixtures N87-14249
Techniques to achieve high-speed computations in supercomputers N87-14250
VP series hardware N87-14251
On a data base system for numerical simulator N87-14252
Database oriented UNIX operating environment and its application N87-14253
Implicit time-marching methods for the transonic Euler equations N87-14254
Three-dimensional potential flow simulations for transonic inlets N87-14255
Compressible flow analysis in turbomachinery N87-14256
Development of the highly loaded axial flow turbine airfoils, making use of the improved inverse channel flow design method N87-14257
An easily vectorizable numerical solution of the Euler equations N87-14258
A finite element method for high Reynolds number flow N87-14259
Developments of Navier-Stokes code for hypersonic space-flight vehicles N87-14260
Development of supersonic computational aerodynamic program using panel method N87-14261
Some numerical calculations by using linear classical sonic theories approached from sub- or supersonic speeds N87-14262
Application of the e sup N method to calculations of laminar flow control N87-14263
Computational study of flow in curved pipes with circular-section N87-14264
Effects of boundary conditions in numerical experiments for turbulent flows N87-14265
Numerical simulation of transonic flow fields by solving the three-dimensional Navier-Stokes equations N87-14266
The reliability of numerical solutions for the viscous transonic flows over an airfoil N87-14267
Computational study of flow around an airfoil at high angles of attack by a block pentadiagonal matrix method N87-14268
Computations of two- and three-dimensional flows using an adaptive mesh N87-14269
Direct numerical control in grid generation N87-14270
Two-dimensional incompressible flows around an airfoil at several attack angles N87-14271
Computational study of three-dimensional wake structure N87-14272
Transonic aileron computation in comparison to wind tunnel test N87-14273
Investigation of a prediction method of transonic flutter characteristics using unsteady transonic aerodynamics N87-14274
Transonic wing and airfoil design using inverse code WINDES N87-14275
Application of computational aerodynamics to wing design under fuselage interference N87-14276
The role of computational fluid dynamics in aeronautical engineering: Third report N87-14277

NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.

On 10-60 GHz G/T measurements using the Sun as a source: A preliminary study [PB86-230034] N87-14595

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High-temperature corrosion and methods of its control [PB86-229663] N87-14484
Report on an interlaboratory electromigration experiment [AD-A169652] N87-15006

NATIONAL CHEMICAL LAB. FOR INDUSTRY, TOKYO (JAPAN).

A stabilized dc plasma and an advanced spectrochemical analysis system N87-14458

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Solar-geophysical data number 502, June 1986. Part 1: (Prompt reports). Data for May 1986, April 1986 and late data [PB86-224011] N87-14803
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Remote detection of aircraft icing conditions using microwave radiometers [PB86-229507] N87-14806

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Basic program for eddy correlation in non-simple terrain
[PB86-227501] N87-14789
Temporal characteristics of solar EUV, UV and 10830-A full-disk fluxes
[PB86-231271] N87-15042

NATIONAL PHYSICAL LAB., TEDDINGTON (ENGLAND).
Commissioning trials on a large-area thermal conductance apparatus and the thermal performance of a ceramic fibre furnace lining
[NPL-DMA(A)-85] N87-14513
The modelling of creep for engineering design-1
[NPL-DMA-A115] N87-14727
A review of methods of personal identity verification
[NPL-DITC-73/86] N87-15022
Activities report of the Division of Radiation Science and Acoustics
[ETN-86-98616] N87-15157

NATIONAL RADIO ASTRONOMY OBSERVATORY, TUCSON, ARIZ.
Pervasive small-scale structure in molecular clouds N87-15055

NAVAL ACADEMY, ANNAPOLIS, MD.
A computer simulation of detonation within an energetic molecular crystal
[AD-A171662] N87-14472
Fundamentals of vortex motion N87-14631
Review of vortex flows N87-14632
A three dimensional viscous vortex N87-14633
Turbulent vortices N87-14634
Measurements of the impingement of a vortex flow on a control surface by 3D laser velocimetry N87-14643

NAVAL MEDICAL RESEARCH INST., BETHESDA, MD.
Investigation of potential behavioral effects of exposure to 60 hz electromagnetic fields
[AD-A169650] N87-14830

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
Nonlinear pixel replacement estimation
[AD-A168882] N87-14973

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Satellite orbit programs utilizing the graphics capabilities of the microcomputer
[AD-A172485] N87-14416
A user-oriented performance index for packet switched networks
[AD-A168903] N87-14570
Parameterization of overwater horizontal wind variability
[AD-A169331] N87-14807
Non-roman font generation via interactive computer graphics
[AD-A170614] N87-14880
Surface reconstruction from planar contours
[AD-A171617] N87-14884

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Oxidation of silicon, silicon carbide (SiC) and silicon nitride (Si3N4)
[AD-A168886] N87-14519
Renormalization of an inverse scattering theory for Gaussian dielectric profiles
[AD-A169328] N87-14571
IRAS observations of giant molecular clouds in the Milky Way N87-15089
A search for precursor activity associated with coronal mass ejections, using white-light coronagraph observations obtained with the SOLWIND instrument on board the Air Force P78-1 satellite
[AD-A170139] N87-15152

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
Underwater explosion modeling of an energy absorption system
[AD-A168880] N87-14646

NAVAL TEST PILOT SCHOOL, PATUXENT RIVER, MD.
Derivation of the radar range equation for a pulse-Doppler radar with range and velocity gating and coherent and noncoherent pulse integration
[AD-A170354] N87-14573

NEW MEXICO UNIV., ALBUQUERQUE.
Asphalt-rubber SAMI (Stress-Absorbing Membrane Interlayers) field evaluation
[AD-A169700] N87-14356

NICOLAUS COPERNICUS UNIV., TORUN (POLAND).
Unusual relative strengths of the diffuse interstellar bands in some interstellar dust clouds N87-15105

NORTH CAROLINA UNIV., CHAPEL HILL.
Low temperature silicon oxidation studies
[AD-A169699] N87-14470
Queueing analysis of fault-tolerant computer systems
[AD-A170303] N87-14865

NORTH TEXAS STATE UNIV., DENTON.
The construction of low noise optical correlation filters and their application to target identification problems
[AD-A170629] N87-14577

NORTHEASTERN UNIV., BOSTON, MASS.
Spectroscopic characterization studies of phase transformations in zirconia, hollandite and graphite systems
[DE86-015069] N87-14532
Nicad battery packages
[AD-A170140] N87-14598

NUCLEAR MATERIALS CORP., CAIRO (EGYPT).
Analyses of the phosphate standard of the Egyptian Nuclear Materials Corporation (phosphate 1) N87-14459

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Stress rupture of carbon fiber composite materials
[DE86-012854] N87-14443

OAK RIDGE NATIONAL LAB., TENN.
Composite model of microstructural evolution in austenitic stainless steel under fast neutron irradiation
[DE87-000018] N87-14503
Remote operation and maintenance demonstration facility at the Oak Ridge National Laboratory
[DE86-012621] N87-14706
In-situ TEM studies of crack tip deformation in molybdenum
[DE86-013346] N87-14740
Photobiological hydrogen production in green algae and photosynthetic bacteria
[DE86-015918] N87-14833
Radiation effects in space
[DE86-013257] N87-14841

OAK RIDGE Y-12 PLANT, TENN.
Analytic signal converter for nondestructive testing
[DE86-012720] N87-14720

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Jeans criterion in a turbulent medium N87-15065
Fragmented molecular complexes: The role of the magnetic field in feeding internal supersonic motions N87-15125

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).
Forced motion on spinning test for slosh-moment investigations N87-14406
Microwave measurement of the combustion velocity of solid propellants (4)
[ONERA-RTS-11/3173-EY] N87-14476
Measurement of pressure fluctuations on the wall of a turbulent combustion furnace
[ONERA-RTS-47/7104-EY] N87-14478
Transient response of immersed structures
[ONERA-RT-29/3043-RY-044-R] N87-14743

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Materials science in Europe
[AD-A170214] N87-14435
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[AD-A172479] N87-15032

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Alternative mathematical programming formulations for FSG synthesis
[NASA-CR-180030] N87-14872
Distributed knowledge base systems for diagnosis and information retrieval
[AD-A170830] N87-15025
Emission line region kinematics in selected Seyfert galaxies
[NASA-CR-180029] N87-15035

OXFORD UNIV. (ENGLAND).
Robust stability under additive perturbations: An implicit assumption
[OUEL-1622/86] N87-14912
Reduced complexity set-point following in self-tuning control
[OUEL-1626/86] N87-14913
Model reduction of sampled data systems
[OUEL-1625/86] N87-14930

P

PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Overview of biomass thermochemical liquefaction research sponsored by the US Department of Energy
[DE86-015058] N87-14539
Updated wind energy resource assessment of the US
[DE86-015788] N87-14773

PAGE (R. J.) CO., SANTA ANA, CALIF.
A design study of hydrazine and biowaste resistojets
[NASA-CR-179510] N87-14425

PANAMETRICS, INC., WALTHAM, MASS.
Absorption and scattering by conductive fibers: Basic theory and comparison with asymptotic results
[AD-A170771] N87-14578

PENNSYLVANIA STATE UNIV., STATE COLLEGE.
Wall pressure fluctuations and acoustics in turbulent pipe flow
[AD-A173359] N87-14655

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
High temperature oxidation studies on alloys containing dispersed phase particles and clarification of the mechanism of growth of SiO(sub)2
[AD-A173210] N87-14496
Bubble dynamics and cavitation inception theory
[AD-A170603] N87-14650
A study to monitor microseismic activity to detect sinkholes
[DOT/FAA/PM-86/34] N87-14792
Sum rules for optical extinction and scattering by small particles
[AD-A170815] N87-14978

PENNSYLVANIA UNIV., PHILADELPHIA.
Research in image understanding as applied to 3-D microwave tomographic imaging with near optical resolution
[AD-A173063] N87-14981

PERSON-SYSTEM INTEGRATION, INC., ALEXANDRIA, VA.
Expert system design aid for applications of human factors in robotics
[AD-A169632] N87-14854

PHYSICAL SCIENCES, INC., ANDOVER, MASS.
Infrared optical property measurement techniques. Definition and preliminary design
[AD-A170426] N87-14975

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT, BRUNSWICK (WEST GERMANY).
Investigation of the optical properties of solar cells
[BMFT-FB-T-86-008] N87-14989

PITTSBURGH UNIV., PA.
Advanced high temperature coating systems beyond current state of the art systems
[AD-A170192] N87-14523
Detection of outliers in multivariate linear regression model
[AD-A170030] N87-14933
On strongly consistent estimates of regression coefficients when the errors are not independently and identically distributed
[AD-A170076] N87-14936
Normalizing transformations of some statistics of Gaussian ARMA processes
[AD-A170184] N87-14942

PRATT AND WHITNEY AIRCRAFT, WEST PALM BEACH, FLA.
Laboratory spectrometer for wear metal analysis of engine lubricants
[AD-A170338] N87-14524

PRINCETON UNIV. OBSERVATORY, N. J.
Depletions and extinction curves for lines of sight through the outer edges of truly dense molecular clouds N87-15110

PROGRAM RESOURCES, INC., RESEARCH TRIANGLE PARK, N.C.
Effects of gridded precipitation bias on wet deposition predictions
[PB86-230091] N87-14823

R

RAND CORP., SANTA MONICA, CALIF.
Soviet development of gyrotrons
[AD-A169680] N87-14690

REMIC CORP., ELKHART, IND.
Development of a communication system compatible with chemical protective clothing and equipment
[NASA-CR-177040] N87-14861

RENSSELAER POLYTECHNIC INST., TROY, N.Y.
Modeling of infrared flux spectra from disk-shaped interstellar dust clouds N87-15049

REPORT STORE, LAWRENCE, KANS.
Anthropometric comparison - USA and USSR
[AD-A173070] N87-14857

RESEARCH INST. OF NATIONAL DEFENCE, LINKOEPING (SWEDEN).
Detection and representation of planar surfaces in three dimensional range images
[FOA-C-30427-E1] N87-14588
On hierarchical edge matching in digital images using distance transformations
[FOA-B-30094-E1] N87-14902

RESEARCH INST. OF NATIONAL DEFENCE, STOCKHOLM (SWEDEN).
Model for describing probability distributions in chains of events
[FOA-C-20619-2.6(2.7)] N87-14947
RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N.C.
Study of mean free path effects on growth of ultrafine metallic aerosols
[AD-A173068] N87-14473
RHODE ISLAND UNIV., KINGSTON.
The Gulf Stream dynamics experiment. Inverted echo sounder data report for the April 1983 to June 1984 deployment period
[AD-A170757] N87-14826
RICE UNIV., HOUSTON, TEX.
Turbulence in HII regions N87-15070
RITTER OBSERVATORY, TOLEDO, OHIO.
Spectroscopy and CCD-photography of extended red emission in reflection nebulae N87-15102
ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Ceramic barrier turbine blade demonstration
[AD-A169698] N87-14350
Inertial fusion power for space applications
[DE86-011879] N87-14969
ROCKWELL INTERNATIONAL CORP., GOLDEN, COLO.
Process and apparatus for sensing defects on a smooth cylindrical surface in tubing
[DE86-013681] N87-14719
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
Nonlinear wave propagation study
[AD-A170201] N87-14572
Studies of phase-conjugate optical device concepts
[AD-A170203] N87-14974
ROYAL AIR FORCE COLL., CRANWELL (ENGLAND).
Production of a digital computer simulation of the trajectory of a thrust vector controlled air to air missile in three dimensions
[ETN-86-98359] N87-14899
ROYAL AIR FORCE INST. OF AVIATION MEDICINE, FARNBOROUGH (ENGLAND).
Emergency exits for underwater escape from rotorcraft
[AEG-REPT-528] N87-14304
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
A method for the manufacture of model helicopter rotor blades from glass fiber reinforced plastic
[RAE-TR-85040] N87-14316
A practical guide to the design of rhombic aerials
[RAE-TM-RAD-NAV-266] N87-14566
Modeling three dimensional vortex flow in aerodynamics N87-14636
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[RAE-TR-85080] N87-14951
ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
Double layers and circuits in astrophysics
[NASA-CR-180018] N87-15136
RUTHERFORD HIGH ENERGY LAB., CHILTON (ENGLAND).
The abundance of interstellar sulphur and zinc in high density sight-lines N87-15123

S

SACLANT ASW RESEARCH CENTER, LA SPEZIA (ITALY).
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[AD-A170359] N87-14574
A directory of ground control points for mapping satellite images over the northeastern Atlantic Ocean and adjacent seas
[AD-A170290] N87-14765
Numerical simulations of the circulation of the eastern Mediterranean
[AD-A170219] N87-14825
SANDIA NATIONAL LABS., ALBUQUERQUE, N. MEX.
Analysis of shock and vibration environments for cargo on C9B transport aircraft
[DE86-016101] N87-14322
Effects of an electronic component radiation qualification program on satellite longevity and shielding
[DE86-011093] N87-14417
Shock-induced solid-state chemical reactivity studies using time-resolved radiation pyrometry
[DE86-013576] N87-14474
Surface chemistry of ceramic thin film and powder surfaces
[DE86-012657] N87-14529
Calibration of an electrooptical post for intense microwave detection in a rectangular waveguide
[DE86-015573] N87-14583
Frequency response functions of a nonlinear system
[DE86-016103] N87-14742
Developments in blade shape design for a Darrieus vertical axis wind turbine
[DE86-016056] N87-14774
Climatological assessment of airblast propagations from explosion tests at White Sands Missile Range
[DE86-014942] N87-14786
Inertial fusion power for space applications
[DE86-011879] N87-14969
Materials surface modification by plasma bombardment under simultaneous erosion and redeposition conditions
[DE86-014345] N87-15003
Survey of materials and device technologies for high-temperature (T300C) power semiconductor electronics
[DE86-015822] N87-15017
Hole transport and charge transfer in GaAs/InGaAs GaAs single strained quantum well structures
[DE86-016098] N87-15018
SATCOM INTERNATIONAL, PARIS (FRANCE).
Analysis of rendezvous and docking in geostationary Earth orbit. Rider to comparison of future communications space segment concepts
[DM51-C/PL/FL/0099.82] N87-14364
Comparison of future communications space segment concepts
[DM51-C/PM/FL/0100.82] N87-14419
SCHONSTEDT INSTRUMENT CO., RESTON, VA.
Postflight evaluation of the solar maximum spacecraft magnetometers N87-14380
SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
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[ESA-CR(P)-2232] N87-14798
SEP GESELLSCHAFT FUER TECHNISCHE STUDIEN, ENTWICKLUNG, PLANUNG M.B.H., MUNICH (WEST GERMANY).
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[BMFT-FB-T-86-011] N87-14708
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[STPA-42744] N87-14447
SIMULA, INC., PHOENIX, ARIZ.
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[DOT/FAA/CT-86/25-2] N87-14307
SINGER-LINK-MILES LTD., LANCING (ENGLAND).
A simulated instrument, serial bus system
[LM/TR/654/2/2] N87-14329
SIRA INST. LTD., CHISLEHURST (ENGLAND).
Evaluation of low density mirror blanks for space observatories
[SIRA-A/7123/00] N87-14987
SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Spacelab Lyman Alpha-White Light Coronagraph Program
[NASA-CR-177902] N87-14674
High resolution astrophysical observations using speckle imaging
[AD-A170430] N87-15036
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[TS/SL/194/DV/30.094/82] N87-14429
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, SURESNES (FRANCE).
Study of the Ti 15-3-3 titanium alloy in thin plate form
[SNIAS-45-656] N87-14510
Fault detection sensitivity in thick light alloy specimens, test report
[REPT-47-084/F] N87-14721
SOFREAVIA, PARIS (FRANCE).
The data circulation mission in the Meteosat 2000 program
[ESA-CR(P)-2221] N87-14817
SOUTH CAROLINA UNIV., COLUMBIA.
Regenerative sampling and monotonic branching processes
[AD-A170145] N87-14940
On prediction intervals for future observations from the inverse Gaussian distribution
[AD-A170209] N87-14944
SOUTHAMPTON UNIV. (ENGLAND).
Vehicle geometry effects on hypersonic stability and control N87-14397
Activities report of the Institute of Sound and Vibration Research
[ETN-86-98365] N87-14745
CEC joint study of community response to aircraft noise 1984: Main report. The influence of residual noise on disturbance from aircraft noise
[DR-8601] N87-14782
The effect of changes in cerebrospinal fluid pressure on the labyrinth in terms of tympanic membrane displacement
[ISVR-TR-135] N87-14843
Whole-body vibration and aircrew performance
[ISVR-TR-132] N87-14859
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Study of the influence of metallurgical factors on fatigue and fracture of aerospace structural materials
[AD-A170218] N87-14493
SPECTROLAB, INC., SYLMAR, CALIF.
Design, analysis and test verification of advanced encapsulated systems
[NASA-CR-177076] N87-14619
SPERRY FLIGHT SYSTEMS, PHOENIX, ARIZ.
Solar maximum mission post flight performance analyses of standard reaction wheels S/N's 102, 103, 104 and 105 N87-14381
STANFORD UNIV., CALIF.
An investigation of the structure and high temperature mechanical properties of oxide dispersion strengthened alloys
[AD-A173356] N87-14498
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall
[SU-HMT-38] N87-14620
Experiments on buoyancy-induced convection heat transfer from an array of cubical elements on a vertical channel wall. Chapter 1: Introduction and background N87-14621
Analysis of conduction from a heated cubical element to a plane conducting wall, appendix A N87-14622
Measurement of the temperature-dependent thermal conductivity of an epoxy adhesive for use in an element base conduction gauge, appendix B N87-14623
Radiation from an element in an array to its surroundings, appendix C N87-14624
Hot-wire calibration at very low velocities with temperature compensation, appendix D N87-14625
A computer interface for digital control of a dc power source, appendix E N87-14626
Differential derivation of the fully developed limit on the induced channel Reynolds number, appendix F N87-14627
Derivation of a general integral formulation for the buoyancy-induced Reynolds number, appendix G N87-14628
Derivation of Steinberg's method for predicting induced flow in cabinets N87-14629
Laser physics and laser techniques
[AD-A171949] N87-14697
The complexity of parallel algorithms
[AD-A172445] N87-14885
On the relation between several statistics for testing for exponentiality and uniformity
[AD-A170259] N87-14945
Fundamental processes in partially ionized plasmas
[AD-A170029] N87-14999
An atlas of photospheric magnetic field observations and computed coronal magnetic fields: 1976 - 1985
[NASA-CR-180019] N87-15151
STATE UNIV. OF NEW YORK, BUFFALO.
Theory of spectroscopy and dynamics in laser-irradiated adspecies-surface systems
[AD-A170148] N87-14471
Effects of static lung loading on cardiorespiratory function in submerged exercising subjects at depth
[AD-A170914] N87-14840
Photodissociation of molecules at structured metallic surfaces
[AD-A169623] N87-14962
STATE UNIV. OF NEW YORK, STONY BROOK.
Portable operating systems for network computers: Distributed operating systems support for group communications
[AD-A170113] N87-14905

A note on Bayes empirical Bayes estimation by means of Dirichlet processes
[AD-A170039] N87-14934

STOCKHOLM UNIV. (SWEDEN).
Results from prediction of cloudiness with a limited area model
[DM-48] N87-14821

STUTTGART UNIV. (WEST GERMANY).
Thermodynamic and Flow Mechanical Problems in Aircraft and Spacecraft Drives
[ETN-87-98751] N87-14331
Interferometry N87-14332
Elementary-reaction and flow-mechanical problems in aircraft and spacecraft drives N87-14333
Mass spectrometric concentration measurements in supersonic flows with chemical reactions N87-14334
Relaxation of vibrational degrees of freedom N87-14335
Flame diagnosis using coherent anti-Stokes Raman scattering (CARS) N87-14336
Multidimensional supersonic flow with supply of heat N87-14337
Combustion process of hydrogen-air mixtures under technical conditions N87-14338
Jet mixing low N87-14339
Design of profiles for cascades N87-14340
Computation of unsteady, compressible flow in counter-rotating plane blade cascades N87-14341
Supercritical blade cascade design N87-14342
Calculation and analysis of chemically reacting supersonic flows N87-14343
Transonic and supersonic compressors N87-14344
Combined propulsion systems, aerothermodynamic processes and an evaluation study of propulsion components and systems N87-14345
Effect of Reynolds number on turbomachines N87-14346
Computation of flow through multistage turbomachines taking into account flow losses and heat fluxes N87-14347
Monodisperse droplet streams and their application in space N87-14407

SVERDRUP TECHNOLOGY, INC., CLEVELAND, OHIO.
Effects of droplet interactions on droplet transport at intermediate Reynolds numbers
[NASA-CR-179567] N87-14348
Conceptual definition of a technology development mission for advanced solar dynamic power systems
[NASA-CR-179482] N87-14771

SWEDISH STEEL A.B., LULEA.
Load interaction effects on fatigue crack propagation in steels of varying strength
[FFA-TN-1986-47] N87-14747

SYSTEMS TECHNOLOGY, INC., HAWTHORNE, CALIF.
Archive data base and handling system for the Orbiter flying qualities experiment program
[NASA-CR-166622] N87-14351

T

TATA INST. OF FUNDAMENTAL RESEARCH, BOMBAY (INDIA).
Lower mass limit of an evolving interstellar cloud and chemistry in an evolving oscillatory cloud N87-15064

TECHNISCHE HOCHSCHULE, AACHEN (WEST GERMANY).
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[BMFT-FB-T-86-056] N87-14507

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Production of aluminum-silicon carbide composites
[ETN-86-98698] N87-14446
Isothermal resistivity measurements on Fe40Ni40B20 and Pd80Si20
[ETN-87-98697] N87-14477
The influence of the pouring rate on the mechanical properties of sand castings made of the alloy G-AlSi7Mg. Building and testing of a low pressure sand casting machine
[ETN-86-98702] N87-14509
The effect of process parameters on the internal quality of an aluminum die casting
[ETN-86-98703] N87-14556
The continuous production of stir cast material
[ETN-87-98701] N87-14557
The influence of a number of welding parameters on the solidification structure of Tungsten-Inert-Gas (TIG) welded aluminum alloys
[ETN-87-98695] N87-14714
Pulsed MIG welding. Tables and figures
[ETN-87-98698] N87-14715
Pulsed MIG welding, text
[ETN-87-98699] N87-14716
Numerical calculations of extrusion by conical molds
[ETN-87-98700] N87-14748
Measurement of parameters for nonlinear object-size filters in images
[ETN-87-98694] N87-14932
Further developments of the Solid State Automated Microscope (SSAM)
[ETN-87-98693] N87-14991

TECHNISCHE HOGESCHOOL, EINDHOVEN (NETHERLANDS).
Development of transmission facilities for electronic media in the Netherlands
[EUT-86-E-158] N87-14585
Short-circuit current interruption in a low-voltage fuse with ablating walls
[EUT-85-E-151] N87-14612
Sharpening of horizontal luminance transitions in television pictures by the simultaneous reduction of bundle current and horizontal scan speed
[E-EEA/324/84] N87-14613
A noise reduction system for video signals with a low signal to noise ratio
[ETN-86-98720] N87-14614
Force sensor based on the magnetoelastic effect
[ETN-86-98719] N87-14681
The dynamic behavior of an industrial robot with two degrees of freedom
[ETN-86-98722] N87-14712
Eindhoven Schematic Editor (ESCHER) reference manual
[EUT-86-E-157] N87-14897
Examination results in context MBA
[EUT-85-E-150] N87-14900
Verification and modification of the dc MOS-transitor model of Poorter
[E-EEA/323/10/1984] N87-15020

TECHNISCHE UNIV., HAMBURG (WEST GERMANY).
Rocket plume contamination and surface interaction effects N87-14405

TELEDYNE SYSTEMS CO., NORTHRIDGE, CALIF.
Failure analysis and performance evaluation of NASA inertial reference unit (DFIRU 2) after 50 months of orbital operation N87-14378

TENNESSEE UNIV., KNOXVILLE.
Investigation of RF emissions from two beams interacting with an electric field dominated plasma
[AD-A170043] N87-15000

TERRA TEK, INC., SALT LAKE CITY, UTAH.
Static and dynamic testing of interceptor substructures
[AD-A169732] N87-14731

TEXAS A&M UNIV., COLLEGE STATION.
Nonlinear dynamic response of composite rotor blades
[AD-A173069] N87-14321
Organizations as information processing systems
[AD-A173362] N87-15026

TEXAS UNIV., ARLINGTON.
The handling qualities of a large jet transport aircraft in severe wind shear and turbulence N87-14353

TEXAS UNIV., AUSTIN.
Large signal modeling and analysis of the GaAs MESFET
[AD-A170304] N87-15011
Image restoration and superresolution as probes of small scale far-IR structure in star forming regions N87-15048
Near-infrared spectroscopy of planetary nebulae: How strong is the H2 emission? N87-15074

TEXAS UNIV., DALLAS.
Activities of the 1st International Laser Science Conference
[AD-A173060] N87-14699

THREE-K AKUSTIKBYRAN A.B., STOCKHOLM (SWEDEN).
Magnitude equivalence of random loads and superposition with transient excitations
[TR-5.338] N87-14418

TOKYO SCIENCE UNIV. (JAPAN).
Thermal extraction of krypton in aluminum using a mass spectrometer N87-14462

TORONTO UNIV., DOWNSVIEW (ONTARIO).
Balloon instrumentation engineering and development
[AD-A170225] N87-14678

TRW DEFENSE SYSTEMS GROUP, HOUSTON, TEX.
Engineering description of the ascent/descent bet product
[NASA-CR-171953] N87-14915

TRW, INC., REDONDO BEACH, CALIF.
Phased Array Laser System (PALS)
[AD-A169635] N87-14689

U

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, HARWELL (ENGLAND).
FRACTURE: A novel technique to investigate the high temperature oxidation of the 20%Cr/25%Ni/Nb stainless steel
[AERE-R-11937] N87-14511
Effect of specimen size and geometry on ductile crack growth resistance in C-Mn steel
[AERE-R-12138] N87-14512
The use of frequency averaging techniques to enhance TOFD images from austenitic welds
[AERE-R-12159] N87-14726
Effect of non-alignment of specimen and texture axes on the measurement of stress using the ultrasonic SH wave technique
[AERE-R-12071] N87-14754
The application of ultrasonic attenuation spectral analysis to materials characterisation
[AERE-R-11885] N87-14755
Diffraction of elastic waves by defects in plates: Calculated arrival strengths for point force and thermoelastic sources of ultrasound
[AERE-R-11456] N87-14756
Angular dependence of the ultrasonic SH wave velocity in rolled metal sheets
[AERE-R-12077] N87-14757
Calculation of activation energies for defect movement during coincidence boundary migration in nickel oxide using computer simulation techniques
[AERE-R-11909] N87-15021

UNITED KINGDOM INFRARED TELESCOPE UNIT, HILO, HAWAII.
Some recent infrared spectroscopy of interstellar processes N87-15107

UNITED TECHNOLOGIES CORP., FARMINGTON, CONN.
Electrochemical reduction of carbon dioxide
[AD-A169630] N87-14468

UNIVERSAL ENERGY SYSTEMS, INC., DAYTON, OHIO.
Methods of plasma excitation
[AD-A170347] N87-15002

UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO, MEXICO CITY.
The asymmetric profile of the H76 alpha line emission from MWC349 N87-15052
Optical observations of very low ionization HII regions in the large Magellanic cloud N87-15072
Chemical evolution in spiral and irregular galaxies N87-15097

UNIVERSITY COLL., CARDIFF (WALES).
Some evidence on non-transmissibility of acute upper respiratory disease and related matters
[PREPRINT-115] N87-14842
On deliberate misreferencing as a tool of science policy
[PREPRINT-125] N87-15027
The relation of bacterial absorptivity in the 3 to 4 micron waveband to observations of GC-IRS7 and sundry comments
[PREPRINT-108] N87-15037
The mystery of the missing shorter period comets
[PREPRINT-123] N87-15041
Organic grains in comets
[PREPRINT-122] N87-15137

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Geophysical vortices and vortex rings N87-14635
A precision laser spectrometer system
[AD-A170226] N87-14692
Metaprogramming: A new methodology for the construction of quality software
[AD-A170032] N87-14878

UTAH UNIV., SALT LAKE CITY.
Current noise in sodium beta alumina ceramics and single crystals
[AD-A170412] N87-14525

V

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Intrinsic mechanisms of multi-layer ceramic capacitor failure
[AD-A171678] N87-14604
Fault tolerance in parallel architectures
[AD-A170245] N87-14664

VIRGINIA UNIV., CHARLOTTESVILLE.
The use of novel processing procedures for improving overall fatigue resistance of high strength aluminum alloys
[AD-A170136] N87-14491
The velocity dispersion of the giant molecule clouds: A viscous origin N87-15091

Local interstellar gasdynamical stability in spiral arm flow N87-15092

VOLVO FLYGMOTOR A.B., TROLLHAETTAN (SWEDEN).

Aerodynamic design and test of a supersonic turbine for a rocket engine N87-14400

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).

Two Phase Flows in Major Technological Hazards, volume 2
[VKI-LS-1986-03-VOL-2] N87-14544

Introduction to Vortex Dynamics, volume 1
[VKI-LS-1986-08-VOL-1] N87-14630

Introduction to Vortex Dynamics, volume 2
[VKI-LS-1986-VOL-2] N87-14637

Compressibility effects on delta wing flow fields N87-14641

Compressibility effects on flows around simple components N87-14642

VRIJE UNIVERSITEIT, AMSTERDAM (NETHERLANDS).

Aspects of the Amsterdam multiprocessor PROLOG system
[FVI-86-09] N87-14907

VRIJE UNIVERSITEIT, BRUSSELS (BELGIUM).

Surface tension minimum and Marangoni convection N87-14409

W

WASHINGTON UNIV., SEATTLE.

Stable crack growth in aluminum tensile specimens
[AD-A170299] N87-14494

Implicit time-marching solution of the Navier-Stokes equations for thrust reversing and thrust vectoring nozzle flows
[NASA-CR-4026] N87-14645

Radiative energy transfer and thermal management in advanced space power and propulsion systems
[AD-A170838] N87-14651

Afferent mechanisms of microwave-induced biological effects
[AD-A169979] N87-14831

MOS circuit models in network C
[AD-A169951] N87-14876

Coordinate free LAP
[AD-A169962] N87-14877

WELLESLEY COLL., MASS.

The shapes of the circumstellar silicate features N87-15111

WESTINGHOUSE ELECTRIC CORP., WEST MIFFLIN, PA.

In situ repair of a failed compression fitting
[DE86-013682] N87-14707

WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, PITTSBURGH, PA.

High specific heat dielectrics and Kapitza resistance at dielectric boundaries
[AD-A169964] N87-15007

WISCONSIN UNIV., MADISON.

Milky Way halo gas kinematics N87-15088

Relationships between dust grain components responsible for observed interstellar extinction and polarization N87-15109

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).

International list of selected, supplementary and auxiliary ships
[WMO/OMM-47-ED-86] N87-14819

Composition of the WMO
[WMO/OMM-5] N87-14820

WYOMING UNIV., LARAMIE.

Models of polarized infrared emission from bipolar nebulae N87-15050

The (32)S/(33)S abundance as a function of galactocentric radius in the Milky Way N87-15093

Y

Y-ARD LTD., GLASGOW (SCOTLAND).

The deduction of bearing forces in rotating machinery
[BR99658] N87-14372

YALE UNIV., NEW HAVEN, CONN.

Investigation of superradiant LDV markers and three-component velocity mapping
[AD-A173066] N87-14698

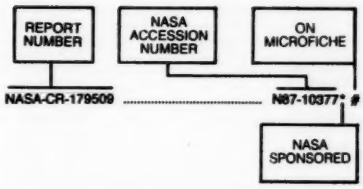
Typical Contract Number Index Listing

Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 2304 ..... N87-14934
AF PROJ. 2311 ..... N87-15152
AF-AFOSR-0022-81 ..... N87-14498
AF-AFOSR-0029-83 ..... N87-14497
AF-AFOSR-0030-84 ..... N87-14849
AF-AFOSR-0055-81 ..... N87-15036
AF-AFOSR-0055-85 ..... N87-14691
AF-AFOSR-0061-83 ..... N87-14491
AF-AFOSR-0075-84 ..... N87-14492
AF-AFOSR-0078-82 ..... N87-14923
AF-AFOSR-0079-82 ..... N87-14812
AF-AFOSR-0089-80 ..... N87-14523
AF-AFOSR-0093-81 ..... N87-15000
AF-AFOSR-0108-83 ..... N87-14998
AF-AFOSR-0132-84 ..... N87-14865
AF-AFOSR-0133-84 ..... N87-14495
AF-AFOSR-0136-84 ..... N87-14934
AF-AFOSR-0138-85 ..... N87-14739
AF-AFOSR-0145-84 ..... N87-14978
AF-AFOSR-0156-84 ..... N87-14940
N87-14944
AF-AFOSR-0160-81 ..... N87-14965
AF-AFOSR-0170-80 ..... N87-14937
AF-AFOSR-0187-82 ..... N87-14919
AF-AFOSR-0199-81 ..... N87-14878
AF-AFOSR-0205-84 ..... N87-14718
N87-14939
AF-AFOSR-0240-81 ..... N87-14981
AF-AFOSR-0255-82 ..... N87-15025
AF-AFOSR-0258-82 ..... N87-14941
AF-AFOSR-0304-82 ..... N87-14579
AF-AFOSR-0306-83 ..... N87-14892
AF-AFOSR-0315-84 ..... N87-14924
AF-AFOSR-0326-82 ..... N87-14875
AF-AFOSR-0344-82 ..... N87-15010
AF-AFOSR-0356-8[illegible] N87-14648
AF-AFOSR-0367-83 ..... N87-14651
AF-AFOSR-0376-84 ..... N87-14920
N87-14921
N87-14922
AF-AFOSR-2928-76 ..... N87-14492
ARPA ORDER 4563 ..... N87-14876
N87-14877
BMFT-1500-637-8 ..... N87-14948
BMVG-T/R-760/F-0007/F-1707 ..... N87-14661
CAA-7D/S/0260/1 ..... N87-14303
DA PROJ. 1L1-62105-AH-84 ..... N87-14350
DA PROJ. 1L1-62209-AH-76 ..... N87-14349
DA PROJ. 1T1-61102-BH-57 ..... N87-14767
DA PROJ. 4A7-62730-AT-42 ..... N87-14554
DAAG-29-83-K-0029 ..... N87-14920
DAAG29-79-C-0115 ..... N87-14906
DAAG29-79-C-0155 ..... N87-14890
DAAG29-81-C-0023 ..... N87-14731
DAAG29-82-K-0088 ..... N87-14961
DAAG29-82-K-0102 ..... N87-14864
DAAG29-82-K-0103 ..... N87-14905
DAAG29-82-K-0119 ..... N87-15006
DAAG29-82-0135 ..... N87-14941
DAAG29-83-K-0029 ..... N87-14921
N87-14922
DAAG29-83-K-0070 ..... N87-15009
DAAG29-84-K-0017 ..... N87-14809
DAAG29-84-K-0045 ..... N87-14865
DAAG29-84-K-0058 ..... N87-14890
N87-14906
DAAG29-84-K-0076 ..... N87-15011
DAAG29-85-G-0122 ..... N87-14699
DAAG46-84-C-0002 ..... N87-14350
DAAK70-83-K-0018 ..... N87-14311
N87-14883
DAAL02-86-P-4734 ..... N87-14857
DAAL03-86-G-0012 ..... N87-14522
DACA78-85-C-0008 ..... N87-15033
DAJA45-84-C-0014 ..... N87-14767
DARPA ORDER 3206 ..... N87-14311
N87-14883
DARPA ORDER 3882 ..... N87-15006
DARPA ORDER 5205 ..... N87-14882
DE-AA03-76SF-00034 ..... N87-14503
DE-AC02-76CH-00016 ..... N87-14502
N87-15135
DE-AC02-76ER-02923 ..... N87-14531
DE-AC02-83CH-10093 ..... N87-15016
DE-AC03-76SF-00098 ..... N87-14609
DE-AC04-76DP-00789 ..... N87-14322
N87-14417
N87-14474
N87-14529
N87-14583
N87-14742
N87-14774
N87-14786
N87-15017
N87-15018
DE-AC04-76DP-03533 ..... N87-14719
DE-AC05-84OR-21400 ..... N87-14706
N87-14740
N87-14833
N87-14841
DE-AC05-84OR21400 ..... N87-14503
DE-AC05-84OS-21400 ..... N87-14720
DE-AC05-84OT-21400 ..... N87-14443
DE-AC06-76RL-01830 ..... N87-14539
N87-14773
DE-AC07-76ID-01570 ..... N87-14858
DE-AC08-83NV-10282 ..... N87-14982
N87-14986
DE-AC11-76PN-00014 ..... N87-14707
DE-AS03-84ER-52104 ..... N87-15003
DE-AS05-80ER-10655 ..... N87-14530
DE-AS08-84DP-40199 ..... N87-14983
N87-14984
N87-14985
DE-AS09-80ER-10671 ..... N87-14538
DE-AT04-85AL-33408 ..... N87-15031
DE-FG02-84ER-45079 ..... N87-14532
DE-FG03-85ER-25009 ..... N87-14886
DE-FG03-86ER-53220 ..... N87-15001
DEN3-181 ..... N87-15030
DFG-AZ. FO-119/3-1 ..... N87-14341
DRET-81-513 ..... N87-14287
DRET-81-1201 ..... N87-14852
DRET-83-34-134 ..... N87-14478
DRET-84-34-OCT N87-14743
DRET-84-34-001 ..... N87-14476
DRET-84-1412/DS/SR N87-14660
DTFA01-84-C-0005 ..... N87-14792
DTFA03-83-C-0036 ..... N87-14307
DTFA03-83-00036 ..... N87-14306
ERI PROJ. 1432 ..... N87-14278
ESA-3724/78-NL-JS N87-14429
ESA-4710/81-NL-PP(SC) N87-14867
ESA-4818/81-NL-MD N87-14364
N87-14419
ESA-5347/83-NL-BI(SC) N87-14359
ESA-5461/83 ..... N87-14418
ESA-5820/84-NL-DG N87-14589
ESA-6152/85-NL-BI N87-14798
ESA-6164/85-F-RD(SC) N87-14817
ESOC-5648/83-D-JS(SC) N87-14363
ESTEC-4956/81-NL-35 ..... N87-14810
ESTEC-5327/83 ..... N87-14406
ESTEC-5412/83-NL-HP(SC) N87-14371
ESTEC-5666/83-NL-PP(SC) N87-14901
ESTEC-5948/84-NL-BI N87-14769
ESTEC-5976/84-NL-PR N87-14987
ESTEC-6419/85-NL-AN(SC) N87-14410
F59-551 ..... N87-14811
F04611-85-C-0060 ..... N87-14975
F04701-85-C-0086 ..... N87-14603
N87-14688
F19628-81-C-0029 ..... N87-14598
F19628-82-C-0041 ..... N87-14678
F19628-83-C-0146 ..... N87-14766
F19628-83-K-0027 ..... N87-14794
F19628-83-K-0040 ..... N87-14808
F19628-85-C-0002 ..... N87-14414
N87-14677
F19628-85-K-0006 ..... N87-15153
F29601-84-C-0080 ..... N87-14356
F30602-81-C-0206 ..... N87-14577
F33615-80-C-2062 ..... N87-15002
F33615-82-C-3215 ..... N87-14319
F33615-83-C-1046 ..... N87-14882
F33615-84-C-2400 ..... N87-14524
F49620-82-C-0044 ..... N87-15013
F49620-82-K-0032 ..... N87-14321
F49620-83-C-0013 ..... N87-14796
F49620-83-C-0054 ..... N87-14493
F49620-83-C-0065 ..... N87-14572
F49620-83-C-0129 ..... N87-15007
F49620-84-C-0017 ..... N87-14473
F49620-84-C-0041 ..... N87-14697
F49620-84-C-0045 ..... N87-14578
F49620-84-C-0066 ..... N87-14879
F49620-84-C-0098 ..... N87-14526
F49620-84-K-0006 ..... N87-15012
F49620-84-K-0008 ..... N87-14847
F49620-85-C-0007 ..... N87-14935
N87-14938
F49620-85-C-0008 ..... N87-14933
N87-14936
N87-14942
F49620-85-C-0041 ..... N87-14838
F49620-85-K-0002 ..... N87-14698
F49620-85-K-0009 ..... N87-14943
GRI-5083-251-0944 ..... N87-14672
MDA903-83-C-0306 ..... N87-14873
MDA903-85-C-0030 ..... N87-14690
MDA903-85-K-0072 ..... N87-14876
N87-14877
MIPR-FY71-218500006 ..... N87-15152
MOD-AT/2040/0180 ..... N87-14859
MOD-A85A/393 ..... N87-14329
MOD-A91A/906 ..... N87-14246
MRC-G8422151N N87-14843
NAG3-159 ..... N87-14872
NAG3-365 ..... N87-14486
NAG3-446 ..... N87-14434
NAG5-10 ..... N87-14568
NAG5-420 ..... N87-14972
NAG5-573 ..... N87-15035
NAG5-769 ..... N87-14567
NAS-7-100 ..... N87-14619
NASW-3511 ..... N87-14368
NASW-4004 ..... N87-14358
N87-14465
N87-15139
N87-15143
NASW-4005 ..... N87-14290
N87-14318
N87-14463
N87-14464
N87-14673
N87-14846
N87-15140
N87-15141
N87-15144
N87-15145
N87-15146
N87-15147
N87-15148
NASW-4006 ..... N87-14305
N87-14317
N87-14541
N87-14553

N87-14729
N87-15142
NAS1-15763 ..... N87-14366
NAS1-17070 ..... N87-14862
NAS1-17170 ..... N87-14645
NAS1-17635 ..... N87-14330
NAS1-18107 ..... N87-14862
NAS2-11900 ..... N87-14351
NAS3-23277 ..... N87-14349
NAS3-23863 ..... N87-14425
NAS3-24105 ..... N87-14348
N87-14771
NAS5-24420 ..... N87-15151
NAS5-26079 ..... N87-14674
NAS5-28728 ..... N87-15150
NAS7-918 ..... N87-14704
N87-14705
NAS8-34136 ..... N87-14424
NAS8-36456 ..... N87-14861
NAS9-17554 ..... N87-14915
NATO-916-83 ..... N87-14409
NCC2-19 ..... N87-14278
NCC2-283 ..... N87-14466
NFR-G-GU-8494-100 ..... N87-14821
NFR-G-GU-8494-101 ..... N87-14821
NGL-22-010-023 ..... N87-15149
NGR05-020-559 ..... N87-15151
NIVR-1968 ..... N87-14288
NSF ATM-74-19007 ..... N87-15151
NSF ATM-77-20580 ..... N87-15151
NSF ATM-80-20421 ..... N87-15151
NSF ATM-82-18215 ..... N87-14811
NSF ATM-83-13271 ..... N87-15151
NSF C-06337 ..... N87-14620
NSF DCR-83-51757 ..... N87-14885
NSF DMS-85-07056 ..... N87-14920
N87-14921
N87-14922
NSF ECS-81-18160 ..... N87-14605
NSF ECS-82-10941 ..... N87-14874
NSF MCS-83-0200 ..... N87-14865
NSF MSM-85-13096 ..... N87-14732
NSF OCE-82-01222 ..... N87-14826
NSF 83-2391-A01-DCR N87-14906
N0014-86-K-0085 ..... N87-15151
N00014-76-C-0207 ..... N87-15151
N00014-77-C-0033 ..... N87-14649
N00014-77-C-0532 ..... N87-14580
N00014-78-C-0205 ..... N87-14840
N00014-80-C-0354 ..... N87-14831
N00014-80-C-0622 ..... N87-14602
N87-14605
N87-14874
N87-14875
N00014-80-K-0947 ..... N87-14811
N00014-81-C-0062 ..... N87-14826
N00014-81-K-0505 ..... N87-14964
N00014-82-C-0452 ..... N87-14979
N00014-82-C-2182 ..... N87-14468
N00014-82-K-0025 ..... N87-14736
N87-14737
N87-14738
N00014-82-K-0154 ..... N87-14890
N87-14906
N00014-82-K-0603 ..... N87-14525
N00014-83-K-0168 ..... N87-14604
N00014-83-K-0341 ..... N87-14490
N00014-83-K-0571 ..... N87-14470
N00014-84-C-0699 ..... N87-14520
N00014-84-K-0345 ..... N87-14911
N00014-84-K-0424 ..... N87-14528
N00014-84-K-0510 ..... N87-14734
N87-14735
N00014-84-K-0519 ..... N87-14580
N00014-85-C-0118 ..... N87-14469
N00014-85-C-0219 ..... N87-14974
N00014-85-C-0278 ..... N87-14696
N00014-85-C-0731 ..... N87-14885
N00014-85-C-2338 ..... N87-14689
N00014-85-G-0015 ..... N87-14964
N00014-85-K-0187 ..... N87-14494
N00014-85-K-0597 ..... N87-14732
N00014-85-K-0757 ..... N87-14963
N00014-85-K-0809 ..... N87-15001
N00014-86-F-0049 ..... N87-14804
N00014-86-F—0049 ..... N87-14803
N00014-86-K-0043 ..... N87-14471
N87-14962
N00014-86-K-0156 ..... N87-14945
N00024-85-C-6041 ..... N87-14650
N60921-85-C-0252 ..... N87-14854
RF PROJ. 764809/717357 ..... N87-15035
RR0-4108 ..... N87-14831
SERC-GR/C/56856 ..... N87-14657
STPA-83-96-013 ..... N87-14510
STPA-84-96-010 ..... N87-14721
W-7405-ENG-36 ..... N87-14700
N87-14850
N87-14966
N87-14986
W-7405-ENG-48 ..... N87-14582
N87-14606
N87-14866
N87-14887
N87-14967
N87-14969
N87-15029
188-48-52 ..... N87-15043
480-52-02 ..... N87-14771
481-02-02 ..... N87-14427
N87-14428
481-50-32 ..... N87-14423
505-31-01 ..... N87-14644
505-31-04 ..... N87-14348
N87-14918
505-33-62 ..... N87-14486
505-45-33-03 ..... N87-14330
505-61-51 ..... N87-14910
505-62-02 ..... N87-14284
505-62-21 ..... N87-14283
N87-14956
505-62-91-01 ..... N87-14645
505-63-01 ..... N87-14483
N87-14487
N87-14488
505-63-11 ..... N87-14489
505-63-31 ..... N87-14730
505-66-51 ..... N87-14310
505-90-01 ..... N87-14998
505-90-21-01 ..... N87-14862
506-42-31 ..... N87-14422
506-43-11 ..... N87-14434
506-43-51-04 ..... N87-14366
506-47-11 ..... N87-14845
506-48 ..... N87-14351
506-55-22 ..... N87-14425
506-58-22 ..... N87-14569
N87-14597
535-05-12 ..... N87-14349
553-13-00 ..... N87-14426
776-81-63 ..... N87-15031
778-35-13 ..... N87-14518

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-85396 ..... N87-14910* #
A-86227 ..... N87-14310* #
A-86305 ..... N87-14644* #
A-86327 ..... N87-14845* #
A-86337 ..... N87-14279* #
A-86393 ..... N87-15043* #
A-87044 ..... N87-14916* #

AD-A168046 ..... N87-15151* #
AD-A168880 ..... N87-14646 #
AD-A168882 ..... N87-14973 #
AD-A168886 ..... N87-14519 #
AD-A168888 ..... N87-14677 #
AD-A168903 ..... N87-14570 #
AD-A169031 ..... N87-14961 #
AD-A169328 ..... N87-14571 #
AD-A169331 ..... N87-14807 #
AD-A169404 ..... N87-14467 #
AD-A169436 ..... N87-14688 #
AD-A169478 ..... N87-14808 #
AD-A169491 ..... N87-14809 #
AD-A169495 ..... N87-14490 #
AD-A169507 ..... N87-14520 #
AD-A169531 ..... N87-14647 #
AD-A169552 ..... N87-14370 #
AD-A169588 ..... N87-14521 #
AD-A169589 ..... N87-14873 #
AD-A169597 ..... N87-14836 #
AD-A169600 ..... N87-14837 #
AD-A169623 ..... N87-14962 #
AD-A169624 ..... N87-14963 #
AD-A169625 ..... N87-14874 #
AD-A169627 ..... N87-14875 #
AD-A169630 ..... N87-14468 #
AD-A169632 ..... N87-14854 #
AD-A169635 ..... N87-14689 #
AD-A169640 ..... N87-14469 #
AD-A169641 ..... N87-14964 #
AD-A169650 ..... N87-14830 #
AD-A169651 ..... N87-14793 #
AD-A169652 ..... N87-15006 #
AD-A169680 ..... N87-14690 #
AD-A169698 ..... N87-14350 #
AD-A169699 ..... N87-14470 #
AD-A169700 ..... N87-14356 #
AD-A169732 ..... N87-14731 #
AD-A169951 ..... N87-14876 #
AD-A169964 ..... N87-15007 #
AD-A169979 ..... N87-14831 #
AD-A169982 ..... N87-14877 #
AD-A170029 ..... N87-14999 #
AD-A170030 ..... N87-14933 #
AD-A170031 ..... N87-15008 #
AD-A170032 ..... N87-14878 #
AD-A170039 ..... N87-14934 #
AD-A170042 ..... N87-14285 #
AD-A170043 ..... N87-15000 #
AD-A170057 ..... N87-14935 #
AD-A170061 ..... N87-15009 #
AD-A170062 ..... N87-14794 #
AD-A170063 ..... N87-15010 #
AD-A170066 ..... N87-14522 #
AD-A170068 ..... N87-14965 #
AD-A170071 ..... N87-14648 #
AD-A170072 ..... N87-14879 #
AD-A170076 ..... N87-14936 #
AD-A170081 ..... N87-14937 #
AD-A170094 ..... N87-14919 #
AD-A170108 ..... N87-15001 #
AD-A170109 ..... N87-14938 #
AD-A170112 ..... N87-14939 #
AD-A170113 ..... N87-14905 #
AD-A170126 ..... N87-14691 #
AD-A170135 ..... N87-14732 #
AD-A170136 ..... N87-14491 #
AD-A170138 ..... N87-14810 #
AD-A170139 ..... N87-15152 #
AD-A170140 ..... N87-14598 #
AD-A170145 ..... N87-14940 #
AD-A170148 ..... N87-14471 #
AD-A170157 ..... N87-14286 #
AD-A170158 ..... N87-14536 #
AD-A170161 ..... N87-14920 #
AD-A170174 ..... N87-14941 #
AD-A170176 ..... N87-15153 #
AD-A170184 ..... N87-14942 #
AD-A170185 ..... N87-14943 #
AD-A170187 ..... N87-14921 #
AD-A170188 ..... N87-14811 #
AD-A170192 ..... N87-14523 #
AD-A170199 ..... N87-14492 #
AD-A170201 ..... N87-14572 #
AD-A170202 ..... N87-14847 #
AD-A170203 ..... N87-14974 #
AD-A170209 ..... N87-14944 #
AD-A170214 ..... N87-14435 #
AD-A170217 ..... N87-14922 #
AD-A170218 ..... N87-14493 #
AD-A170219 ..... N87-14825 #
AD-A170223 ..... N87-14718 #
AD-A170225 ..... N87-14678 #
AD-A170226 ..... N87-14692 #
AD-A170245 ..... N87-14864 #
AD-A170246 ..... N87-14832 #
AD-A170257 ..... N87-14733 #
AD-A170259 ..... N87-14945 #
AD-A170290 ..... N87-14765 #
AD-A170298 ..... N87-14855 #
AD-A170299 ..... N87-14494 #
AD-A170303 ..... N87-14865 #
AD-A170304 ..... N87-15011 #
AD-A170317 ..... N87-14812 #
AD-A170318 ..... N87-14693 #
AD-A170320 ..... N87-14795 #
AD-A170327 ..... N87-14319 #
AD-A170334 ..... N87-14414 #
AD-A170338 ..... N87-14524 #
AD-A170345 ..... N87-15012 #
AD-A170347 ..... N87-15002 #
AD-A170353 ..... N87-14848 #
AD-A170354 ..... N87-14573 #
AD-A170356 ..... N87-15024 #
AD-A170359 ..... N87-14574 #
AD-A170361 ..... N87-14537 #
AD-A170379 ..... N87-14311 #
AD-A170412 ..... N87-14525 #
AD-A170417 ..... N87-14856 #
AD-A170418 ..... N87-14849 #
AD-A170426 ..... N87-14975 #
AD-A170428 ..... N87-14649 #
AD-A170429 ..... N87-14734 #
AD-A170430 ..... N87-15036 #
AD-A170438 ..... N87-14320 #
AD-A170560 ..... N87-14735 #
AD-A170591 ..... N87-14361 #
AD-A170603 ..... N87-14650 #
AD-A170614 ..... N87-14880 #
AD-A170629 ..... N87-14577 #
AD-A170644 ..... N87-14736 #
AD-A170645 ..... N87-14737 #
AD-A170646 ..... N87-14738 #
AD-A170669 ..... N87-14312 #
AD-A170670 ..... N87-14813 #
AD-A170671 ..... N87-14881 #
AD-A170672 ..... N87-14977 #
AD-A170673 ..... N87-14814 #
AD-A170675 ..... N87-14362 #
AD-A170699 ..... N87-14923 #
AD-A170742 ..... N87-14815 #
AD-A170749 ..... N87-14766 #
AD-A170750 ..... N87-14526 #
AD-A170757 ..... N87-14826 #
AD-A170771 ..... N87-14578 #
AD-A170794 ..... N87-14838 #
AD-A170800 ..... N87-14495 #
AD-A170810 ..... N87-14579 #
AD-A170815 ..... N87-14978 #
AD-A170821 ..... N87-14979 #
AD-A170823 ..... N87-14695 #
AD-A170828 ..... N87-14696 #
AD-A170830 ..... N87-15025 #
AD-A170838 ..... N87-14651 #
AD-A170839 ..... N87-14796 #
AD-A170855 ..... N87-14601 #
AD-A170856 ..... N87-14652 #
AD-A170860 ..... N87-15013 #
AD-A170863 ..... N87-14861* #
AD-A170874 ..... N87-14911 #
AD-A170877 ..... N87-14653 #
AD-A170884 ..... N87-14767 #
AD-A170896 ..... N87-14415 #
AD-A170898 ..... N87-14980 #
AD-A170899 ..... N87-14768 #
AD-A170902 ..... N87-14357 #
AD-A170903 ..... N87-14839 #
AD-A170914 ..... N87-14840 #
AD-A170932 ..... N87-14882 #
AD-A171615 ..... N87-14883 #
AD-A171617 ..... N87-14884 #
AD-A171620 ..... N87-14527 #
AD-A171623 ..... N87-14602 #
AD-A171631 ..... N87-14603 #
AD-A171662 ..... N87-14472 #
AD-A171678 ..... N87-14604 #
AD-A171716 ..... N87-14580 #
AD-A171742 ..... N87-14605 #
AD-A171949 ..... N87-14697 #
AD-A172445 ..... N87-14885 #
AD-A172479 ..... N87-15032 #
AD-A172485 ..... N87-14416 #
AD-A173063 ..... N87-14981 #
AD-A173064 ..... N87-14739 #
AD-A173066 ..... N87-14698 #
AD-A173068 ..... N87-14473 #
AD-A173069 ..... N87-14321 #
AD-A173070 ..... N87-14857 #
AD-A173080 ..... N87-14699 #
AD-A173081 ..... N87-14924 #
AD-A173208 ..... N87-14528 #
AD-A173209 ..... N87-15033 #
AD-A173210 ..... N87-14496 #
AD-A173211 ..... N87-14497 #
AD-A173356 ..... N87-14498 #
AD-A173359 ..... N87-14655 #
AD-A173362 ..... N87-15026 #
AD-A173371 ..... N87-15158 #

AD-D012428 ..... N87-14599 #
AD-D012429 ..... N87-14694 #
AD-D012430 ..... N87-14575 #
AD-D012432 ..... N87-14600 #
AD-D012437 ..... N87-14576 #
AD-D012438 ..... N87-14976 #
AD-D012526 ..... N87-14654
AD-D012527 ..... N87-14581 #
AD-D012528 ..... N87-14606 #
AD-D012544 ..... N87-14607 #

AD-E500769 ..... N87-14521 #
AD-E500769 ..... N87-14873 #
AD-E801330 ..... N87-14577 #

AEG-REPT-528 ..... N87-14304

AERE-R-11456 ..... N87-14756 #
AERE-R-11885 ..... N87-14755 #
AERE-R-11909 ..... N87-15021 #

AERE-R-11937 N87-14511 #
AERE-R-12071 N87-14754
AERE-R-12077 N87-14757 #
AERE-R-12138 N87-14512 #
AERE-R-12159 N87-14726 #

AFATL-TR-86-20 N87-14577 #

AFESC/ESL-TR-86-02 N87-14356 #

AFFTC-TR-86-5 N87-14320 #

AFGL-TR-85-0258 N87-14678 #
AFGL-TR-86-0013 N87-14808 #
AFGL-TR-86-0052 N87-14596 #
AFGL-TR-86-0056 N87-15152 #
AFGL-TR-86-0059 N87-14766 #
AFGL-TR-86-0062 N87-15153 #
AFGL-TR-86-0078 N87-14794 #
AFGL-TR-86-0146 N87-14795 #

AFHRL-TR-86-4 N87-14848 #

AFIT/CI/NR-86-67T N87-14768 #
AFIT/CI/NR-86-69D N87-14814 #
AFIT/CI/NR-86-70T N87-14813 #
AFIT/CI/NR-86-75D N87-14815 #
AFIT/CI/NR-86-77D N87-14977 #
AFIT/CI/NR-86-85D N87-14362 #
AFIT/CI/NR-86-86T N87-14312 #
AFIT/CI/NR-86-87T N87-14652 #
AFIT/CI/NR-86-88D N87-14357 #
AFIT/CI/NR-86-89T N87-14415 #
AFIT/CI/NR-86-91T N87-14881 #
AFIT/CI/NR-86-93T N87-14601 #
AFIT/CI/NR-86-94T N87-14980 #
AFIT/CI/NR-86-108T N87-14839 #

AFIT/GSO/ENS/85D-5 N87-14361 #

AFOSR-85-0880TR N87-14648 #
AFOSR-86-0224TR N87-14492 #
AFOSR-86-0274TR N87-14819 #
AFOSR-86-0342TR N87-14999 #
AFOSR-86-0345TR N87-14939 #
AFOSR-86-0349TR N87-14941 #
AFOSR-86-0355TR N87-14718 #
AFOSR-86-0356TR N87-14692 #
AFOSR-86-0359TR N87-14933 #
AFOSR-86-0366TR N87-14938 #
AFOSR-86-0372TR N87-14922 #
AFOSR-86-0373TR N87-14920 #
AFOSR-86-0374TR N87-14921 #
AFOSR-86-0386TR N87-14943 #
AFOSR-86-0388TR N87-14865 #
AFOSR-86-0393TR N87-14936 #
AFOSR-86-0395TR N87-14942 #
AFOSR-86-0412TR N87-14944 #
AFOSR-86-0419TR N87-14878 #
AFOSR-86-0424TR N87-14937 #
AFOSR-86-0425TR N87-14934 #
AFOSR-86-0427TR N87-15036 #
AFOSR-86-0429TR N87-14940 #
AFOSR-86-0442TR N87-14935 #
AFOSR-86-0463TR N87-14879 #
AFOSR-86-0464TR N87-14849 #
AFOSR-86-0474TR N87-15000 #
AFOSR-86-0476TR N87-14965 #
AFOSR-86-0477TR N87-15007 #
AFOSR-86-0481TR N87-14523 #
AFOSR-86-0484TR N87-14812 #
AFOSR-86-0487TR N87-15010 #
AFOSR-86-0492TR N87-14491 #
AFOSR-86-0493TR N87-14493 #
AFOSR-86-0495TR N87-14847 #
AFOSR-86-0497TR N87-14572 #
AFOSR-86-0498TR N87-14691 #
AFOSR-86-0505TR N87-14495 #
AFOSR-86-0509TR N87-15025 #
AFOSR-86-0516TR N87-14578 #
AFOSR-86-0517TR N87-14978 #
AFOSR-86-0529TR N87-15013 #
AFOSR-86-0548TR N87-14923 #
AFOSR-86-0560TR N87-14579 #
AFOSR-86-0565TR N87-14651 #
AFOSR-86-0570TR N87-14526 #
AFOSR-86-0592TR N87-14796 #
AFOSR-86-0860TR N87-15012 #
AFOSR-86-0723TR N87-14697 #
AFOSR-86-0836TR N87-14496 #
AFOSR-86-0843TR N87-14981 #
AFOSR-86-0868TR N87-14924 #
AFOSR-86-0919TR N87-14739 #
AFOSR-86-0920TR N87-14497 #
AFOSR-86-0934TR N87-14321 #
AFOSR-86-0943TR N87-14473 #

AFOSR-86-1002TR N87-14498 #
AFOSR-86-1006TR N87-14696 #

AFRPL-TR-86-034 N87-14975 #

AFWAL-TR-85-2085 N87-15002 #
AFWAL-TR-85-2101 N87-14524 #
AFWAL-TR-86-3003-VOL-2 N87-14319 #
AFWAL-TR-86-4003 N87-14527 #

AIAA-87-0056 N87-14283* #
AIAA-87-0137 N87-14348* #
AIAA-87-0525 N87-14957* #

AMS-85-60 N87-14934 #

AR-1 N87-14496 #
AR-4 N87-15013 #

ARCCB-TR-86020 N87-14733 #

ARL/PSU/TM-86-121 N87-14650 #

ARL/PSU/TR-86-006 N87-14655 #

ARL/SYS-TM-87 N87-14856 #

ARO-18562.1-MS N87-15008 #
ARO-18803.14-EL N87-14864 #
ARO-18822.4-PH N87-14961 #
ARO-18864.12-EL N87-14905 #
ARO-19677.14-EL N87-15009 #
ARO-21438.27-EL N87-15011 #
ARO-23043.1-PH-CF N87-14699 #
ARO-23470.1-MS-CF N87-14522 #

ATCEU-511 N87-14308

ATR-3 N87-15010 #
ATR-85(8367)-1 N87-14449 #

AUD06066S03-13-WLC N87-14481

AWRE-O-21/85 N87-14790 #

BAE-S85/AMR/0060 N87-14243

BLL-CE-TRANS-8252-(9022.09) N87-14481

BLL-TRANS-(3623.66) N87-14485 #

BLL-TRANS-AAEC-798-(1797.43) N87-14728 #

BMFT-FB-DV-86-005 N87-14898 #
BMFT-FB-DV-86-006 N87-14990 #

BMFT-FB-HA-86-004 N87-14555 #

BMFT-FB-T-86-003 N87-14776 #
BMFT-FB-T-86-006 N87-14777 #
BMFT-FB-T-86-007 N87-14778 #
BMFT-FB-T-86-008 N87-14989 #
BMFT-FB-T-86-011 N87-14706 #
BMFT-FB-T-86-018 N87-14988 #
BMFT-FB-T-86-020 N87-14797 #
BMFT-FB-T-86-021 N87-14508 #
BMFT-FB-T-86-051 N87-14818 #
BMFT-FB-T-86-055 N87-14506 #
BMFT-FB-T-86-056 N87-14507 #
BMFT-FB-T-86-059 N87-14779 #

BMFT-FB-W-86-004 N87-14542 #
BMFT-FB-W-86-005 N87-14543 #
BMFT-FB-W-86-006 N87-14611 #
BMFT-FB-W-86-007 N87-14328 #
BMFT-FB-W-86-008 N87-14534 #
BMFT-FB-W-86-009 N87-14711 #

BMFT-KBF-52 N87-14785
BMFT-KBF-58 N87-14784

BNL-38555 N87-15135 #
BNL-38616 N87-14502 #

BPT-1/86 N87-14784
BPT-3/86 N87-14785

BRL-CR-553 N87-14285 #

BRL-MR-3522 N87-14647 #

BRL-TR-2729 N87-14467 #
BRL-TR-2741 N87-14537 #

BR97931 N87-14316
BR98240 N87-14566

BR98761 N87-14304
BR98808 N87-14246 #
BR98858 N87-14514
BR99104 N87-14951 #
BR99150 N87-14783
BR99318 N87-14790 #
BR99658 N87-14372
BR100138 N87-14844
BR100206 N87-14824

B8689019 N87-14656 #
B8689246 N87-14907 #
B8689294 N87-14744 #
B8689754 N87-14926 #
B8689755 N87-14946 #
B8689756 N87-14952 #
B8689757 N87-14953 #
B8689758 N87-14954 #
B8689793 N87-14868 #
B8671258 N87-14927 #
B8671259 N87-14955 #
B8671260 N87-14928 #
B8671261 N87-14896 #
B8671262 N87-14929 #
B8671295 N87-14286 #
B8671566 N87-14889 #
B8671567 N87-14906 #
B8671568 N87-14890 #
B8671569 N87-14891 #
B8671570 N87-14925 #
B8671571 N87-14892 #
B8671572 N87-14893 #
B8671573 N87-14894 #
B8671574 N87-14895 #

CAA-PAPER-84018 N87-14308
CAA-PAPER-84019 N87-14296
CAA-PAPER-85004 N87-14303
CAA-PAPER-85005 N87-14853
CAA-PAPER-85009 N87-14297
CAA-PAPER-85012 N87-14313
CAA-PAPER-85013 N87-14244
CAA-PAPER-85015 N87-14298
CAA-PAPER-85018 N87-14299
CAA-PAPER-86003 N87-14300
CAA-PAPER-86005 N87-14301
CAA-PAPER-86006 N87-14302

CAR-TR-166 N87-14943 #
CAR-TR-202 N87-14883 #

CEAT-C78-PT-1 N87-14533 #

CEAT-M4-475-000 N87-14448 #

CETIM-12-B-162 N87-14445 #
CETIM-12-F-362 N87-14504 #
CETIM-13-J-122 N87-14505 #
CETIM-100-090 N87-14722 #
CETIM-103-480 N87-14679 #
CETIM-102700 N87-14709 #
CETIM-106030 N87-14710 #

CFDU/86/6 N87-14658 #
CFDU/86/7 N87-14659 #

CGR/DC-8/86 N87-14695 #

CNES-CT/DRT/TIT/TR-154-T N87-14584 #

CNES-85/187T/CT/DRT/TIT/RL N87-14828 #

CONF-860582-1 N87-15003 #
CONF-860905-26 N87-14503 #
CONF-860749-1 N87-14529 #
CONF-860756-3 N87-14967 #
CONF-860761-1 N87-14966 #
CONF-860810-22 N87-14969 #
CONF-860810-23 N87-14539 #
CONF-860880-12 N87-14984 #
CONF-860880-13 N87-14983 #
CONF-860880-15 N87-14985 #
CONF-860905-6 N87-14706 #
CONF-860942-1 N87-14773 #
CONF-860962-1 N87-14982 #
CONF-861004-4 N87-14443 #
CONF-861027-1 N87-14417 #
CONF-861091-3 N87-14474 #
CONF-8603139-1 N87-14720 #
CONF-8605190-1 N87-15135 #
CONF-8606145-2 N87-14841 #
CONF-8606154-1 N87-14700 #
CONF-8606166-1 N87-14740 #
CONF-8606166-2 N87-14502 #
CONF-8608118-1 N87-15029 #
CONF-8609105-1 N87-14850 #

CONF-8609105-3 N87-14858 #
CONF-8609127-2 N87-14582 #
CONF-8609150-1 N87-15018 #
CONF-8610100-1 N87-14986 #
CONF-8610137-1 N87-14833 #
CONF-8610140-1 N87-14742 #
CONF-8610140-2 N87-14322 #
CONF-8610142-1 N87-15017 #

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ETN-87-98887 ..... N87-14994 #
ETN-87-98889 ..... N87-14995 #
ETN-87-98890 ..... N87-14668 #
ETN-87-98891 ..... N87-14295 #
ETN-87-98892 ..... N87-14702 #
ETN-87-98893 ..... N87-14394 #

ETS-77 ..... N87-14677 #

EUT-85-E-150 ..... N87-14900 #
EUT-85-E-151 ..... N87-14612 #
EUT-86-E-157 ..... N87-14897 #
EUT-86-E-158 ..... N87-14585 #

FACHTHEMEN-9 ..... N87-14354

FFA-TN-1986-37 ..... N87-14323 #
FFA-TN-1986-44 ..... N87-14746 #

FFA-TN-1986-47 N87-14747 #
FI-447-TB-19 N87-14587 #
FOA-B-30094-E1 N87-14902 #
FOA-C-20619-2.6(2.7) N87-14947 #
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FSU-STATISTICS-M705 N87-14938 #
FSU-STATISTICS-M727 N87-14935 #
FTD-ID(RS)T-0069-86 N87-14536 #
FTD-ID(RS)T-1264-85 N87-14286 #
FVI-86-09 N87-14907 #
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GAO/NSAID-86-45S-7 N87-14315 #
GAO/NSIAD-86-45S-17 N87-15023 #
GARRETT-21-5464 N87-14349* #
GARRETT-31-6190 N87-15030* #
GKSS-86/E/15 N87-14752 #
GKSS-86/E/21 N87-14365 #
GPO-62-885 N87-14369 #
GPO-64-727 N87-15028 #
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GSI-86-12 N87-14870 #
H-1353 N87-14351* #
HARP-CAP-491 N87-14313
HEL-FIO-6/86 N87-14857 #
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I-129/85 N87-14725 #
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IC-85/50 N87-14499 #
IC-85/86 N87-15133 #
IC-85/106 N87-14816 #
IC-85/151 N87-15132 #
IC-85/180 N87-14741 #
IC-85/196 N87-15014 #
IC-85/199 N87-14500 #
IC-85/226 N87-15015 #
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K/TS-11789 N87-14443 #
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KMSF-U1766 N87-14696 #
LA-UR-86-2178 N87-14700 #
LA-UR-86-2244 N87-14850 #
LA-UR-86-2575 N87-14966 #
LBL-21848 N87-14809 #
LC-79-640375-PT-1 N87-14803 #
LC-79-640375-PT-2 N87-14804 #
LCDS-85-24 N87-14922 #
LCDS-85-29 N87-14921 #
LCDS-86-6 N87-14920 #
LIDS-P-1494 N87-14341 #
LIDS-P-1584 N87-14580 #
LM/TR/654/2/2 N87-14329
LMDC-TR-86-1 N87-15024 #
M-19 N87-14787 #
MATRA-EPT/DT/VT068/012 N87-14359 #
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MD-85-38-BK N87-14919 #
ME-4786-85-10 N87-14321 #
MECH-79 N87-14734 #
MECH-82 N87-14735 #
MIT/LCS/TM-302 N87-14602 #
MOD-D/SAFETY/21/141 N87-14783
MOD-103/86 N87-14783
MPE-PAE/EXP-E1-164 N87-14683 #
MPE-PREPRINT-50 N87-15154
MPE-PREPRINT-54 N87-15155
MPE-PREPRINT-57 N87-15156*
MPE-PREPRINT-58 N87-15039 #
MPE-197 N87-14684 #
MPE-198 N87-15040 #
MPIS-1/1986 N87-14968 #
MPIS-2/1986 N87-14475 #
MPIS-3/1986 N87-14293 #
MPIS-5/1986 N87-14960 #
MPIS-7/1986 N87-14294 #
MQAD-TP-917 N87-14514
MTL-MS-86-1 N87-14521 #
MTL-TR-86-5 N87-14731 #
MTL-TR-86-17 N87-14350 #
NAL-SP-5 N87-14247 #
NAS 1.15:86192 N87-15131* #
NAS 1.15:86567 N87-15034* #
NAS 1.15:86829 N87-14910* #
NAS 1.15:87311 N87-14483* #
NAS 1.15:87803 N87-14687* #
NAS 1.15:87994 N87-14541* #
NAS 1.15:88007 N87-14305* #
NAS 1.15:88008 N87-14317* #
NAS 1.15:88010 N87-14358* #
NAS 1.15:88015 N87-15148* #
NAS 1.15:88016 N87-15142* #
NAS 1.15:88247 N87-14310* #
NAS 1.15:88319 N87-14644* #
NAS 1.15:88335 N87-14845* #
NAS 1.15:88341 N87-14279* #

NAS 1.15:88342 ..... N87-15043* #
NAS 1.15:88483 ..... N87-14463* #
NAS 1.15:88486 ..... N87-14673* #
NAS 1.15:88490 ..... N87-14281* #
NAS 1.15:88491 ..... N87-14729* #
NAS 1.15:88492 ..... N87-14465* #
NAS 1.15:88493 ..... N87-14553* #
NAS 1.15:88494 ..... N87-15139* #
NAS 1.15:88497 ..... N87-15143* #
NAS 1.15:88502 ..... N87-14318* #
NAS 1.15:88503 ..... N87-14280* #
NAS 1.15:88507 ..... N87-15144* #
NAS 1.15:88508 ..... N87-15145* #
NAS 1.15:88509 ..... N87-15146* #
NAS 1.15:88510 ..... N87-15147* #
NAS 1.15:88511 ..... N87-15141* #
NAS 1.15:88532 ..... N87-15140* #
NAS 1.15:88536 ..... N87-14846* #
NAS 1.15:88538 ..... N87-14464* #
NAS 1.15:88805 ..... N87-14426* #
NAS 1.15:88819 ..... N87-14518* #
NAS 1.15:88821 ..... N87-14487* #
NAS 1.15:88834 ..... N87-14569* #
NAS 1.15:88836 ..... N87-14597* #
NAS 1.15:88840 ..... N87-14488* #
NAS 1.15:88841 ..... N87-14489* #
NAS 1.15:88852 ..... N87-14428* #
NAS 1.15:88877 ..... N87-14427* #
NAS 1.15:88897 ..... N87-15031* #
NAS 1.15:88907 ..... N87-14730* #
NAS 1.15:88913 ..... N87-14957* #
NAS 1.15:88914 ..... N87-14423* #
NAS 1.15:88916 ..... N87-14956* #
NAS 1.15:88918 ..... N87-14422* #
NAS 1.15:88922 ..... N87-14283* #
NAS 1.15:89274 ..... N87-14374* #
NAS 1.15:89275 ..... N87-15138* #
NAS 1.15:89415 ..... N87-14916* #
NAS 1.21:7037(207) N87-14245*
NAS 1.26:4026 ..... N87-14645* #
NAS 1.26:4038 ..... N87-14366* #
NAS 1.26:166622 ..... N87-14351* #
NAS 1.26:171953 ..... N87-14915* #
NAS 1.26:174912 ..... N87-14349* #
NAS 1.26:177040 ..... N87-14861* #
NAS 1.26:177076 ..... N87-14619* #
NAS 1.26:177900 ..... N87-15150* #
NAS 1.26:177902 ..... N87-14674* #
NAS 1.26:178194 ..... N87-14862* #
NAS 1.26:178202 ..... N87-14330* #
NAS 1.26:178975 ..... N87-14424* #
NAS 1.26:179482 ..... N87-14771* #
NAS 1.26:179510 ..... N87-14425* #
NAS 1.26:179553 ..... N87-14486* #
NAS 1.26:179559 ..... N87-15030* #
NAS 1.26:179562 ..... N87-14434* #
NAS 1.26:179567 ..... N87-14348* #
NAS 1.26:179955 ..... N87-14703* #
NAS 1.26:179979 ..... N87-14278* #
NAS 1.26:180018 ..... N87-15136* #
NAS 1.26:180019 ..... N87-15151* #
NAS 1.26:180020 ..... N87-14486* #
NAS 1.26:180021 ..... N87-15149* #
NAS 1.26:180024 ..... N87-14972* #
NAS 1.26:180025 ..... N87-14568* #
NAS 1.26:180027 ..... N87-14567* #
NAS 1.26:180029 ..... N87-15035* #
NAS 1.26:180030 ..... N87-14872* #
NAS 1.26:180105 ..... N87-14368* #
NAS 1.60:2530 ..... N87-14918* #
NAS 1.60:2601 ..... N87-14284* #
NAS 1.60:2645 ..... N87-14998* #
NAS 1.71:ARC-11641-1 ..... N87-14442* #
NAS 1.71:GSC-13018-1 ..... N87-14596* #
NAS 1.71:LAR-13215-1 ..... N87-14282* #
NAS 1.71:LAR-13490-1 ..... N87-14413* #
NAS 1.71:LAR-13512-1 ..... N87-14675* #
NAS 1.71:LEW-14345-1 ..... N87-14432* #
NAS 1.71:LEW-14392-1 ..... N87-14517* #
NAS 1.71:MFS-28144-1 ..... N87-15004* #
NAS 1.71:MSC-20467-1 ..... N87-14676* #
NAS 1.71:MSC-20964-1 ..... N87-14863* #
NAS 1.71:NPO-16766-1-CU ..... N87-14705* #
NAS 1.71:NPO-16892-1-CU ..... N87-14704* #
NAS 1.71:14346-1 ..... N87-14433* #

NASA-CASE-ARC-11641-1 ..... N87-14442* #

NASA-CASE-GSC-12956-1 ..... N87-14671*
NASA-CASE-GSC-13018-1 ..... N87-14596* #

NASA-CASE-LAR-13173-1 ..... N87-14314*
NASA-CASE-LAR-13215-1 ..... N87-14282* #
NASA-CASE-LAR-13268-1 ..... N87-14669*
NASA-CASE-LAR-13310-1 ..... N87-14559*
NASA-CASE-LAR-13316-2 ..... N87-14515*
NASA-CASE-LAR-13318-1 ..... N87-14516*
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NASA-CASE-LAR-13512-1 ..... N87-14675* #

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NASA-CASE-LEW-14345-1 ..... N87-14432* #
NASA-CASE-LEW-14346-1 ..... N87-14433* #
NASA-CASE-LEW-14392-1 ..... N87-14517* #

NASA-CASE-MFS-25981-1 ..... N87-14670*
NASA-CASE-MFS-25989-1 ..... N87-14420*
NASA-CASE-MFS-26000-1 ..... N87-14971*
NASA-CASE-MFS-28057-1 ..... N87-14355*
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NASA-CASE-MSC-20467-1 ..... N87-14676* #
NASA-CASE-MSC-20635-1 ..... N87-14373*
NASA-CASE-MSC-20964-1 ..... N87-14863* #

NASA-CASE-NPO-16299-1 ..... N87-14584*
NASA-CASE-NPO-16766-1-CU ..... N87-14705* #
NASA-CASE-NPO-16892-1-CU ..... N87-14704* #

NASA-CR-4026 ..... N87-14645* #
NASA-CR-4038 ..... N87-14366* #
NASA-CR-166622 ..... N87-14351* #
NASA-CR-171953 ..... N87-14915* #
NASA-CR-174912 ..... N87-14349* #
NASA-CR-177040 ..... N87-14861* #
NASA-CR-177076 ..... N87-14619* #
NASA-CR-177900 ..... N87-15150* #
NASA-CR-177902 ..... N87-14674* #
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NASA-CR-180027 ..... N87-14567* #
NASA-CR-180029 ..... N87-15035* #
NASA-CR-180030 ..... N87-14872* #
NASA-CR-180105 ..... N87-14368* #

NASA-SP-7037(207) N87-14245*

NASA-TM-86192 ..... N87-15131* #
NASA-TM-86567 ..... N87-15034* #
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NASA-TM-88836 ..... N87-14597* #
NASA-TM-88840 ..... N87-14488* #
NASA-TM-88841 ..... N87-14489* #
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NASA-TM-89415 ..... N87-14916* #

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NASA-TP-2601 ..... N87-14284* #
NASA-TP-2645 ..... N87-14998* #

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NEPRF-CR-86-01 ..... N87-14811 #

NLR-MP-85045-U ..... N87-14868 #
NLR-MP-85082-U ..... N87-14744 #

NLR-TR-84128-U ..... N87-14288 #
NLR-TR-85054-U ..... N87-14656 #

NMERI-WA5-7(5.06) ..... N87-14356 #

NMRDI-2-73-4633 ..... N87-14540 #

NMRI-85-63 ..... N87-14830 #

NOAA-TM-ERL-ARL-146 ..... N87-15042 #
NOAA-TM-ERL-ARL-147 ..... N87-14789 #

NOAA-TM-ERL-WPL-136 ..... N87-14805 #
NOAA-TM-ERL-WPL-137 ..... N87-14806 #

NOSC/TD-879 ..... N87-14973 #

NPL-DITC-73/86 ..... N87-15022

NPL-DMA(A)-85 ..... N87-14513

NPL-DMA-A115 ..... N87-14727

NPS-61-86-014 ..... N87-14807 #

NPS52-86-018 ..... N87-14880 #
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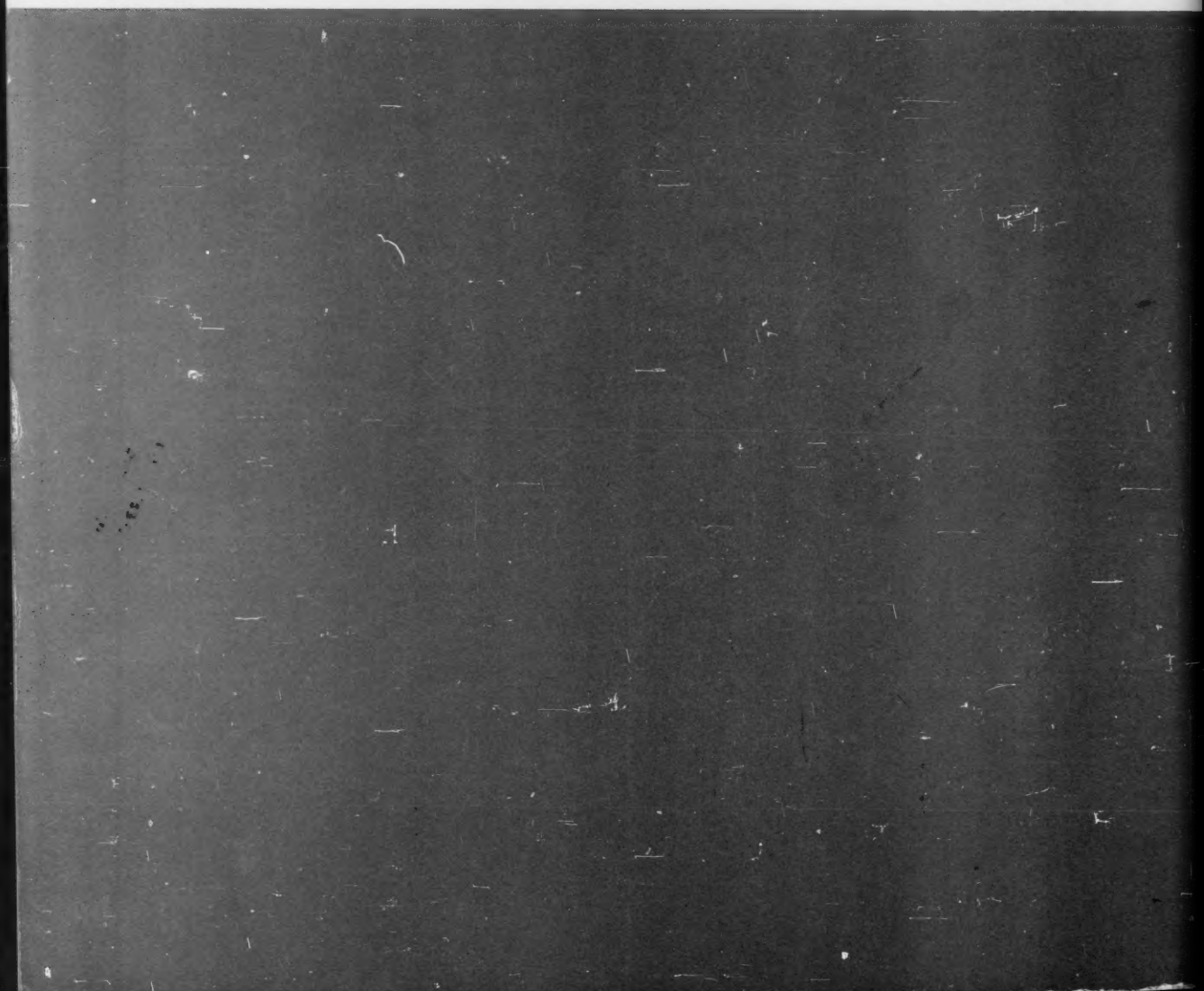
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